

MONTHLY WEATHER REVIEW,

DECEMBER, 1879.

(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In preparing this REVIEW the following data, received up to November 14th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 134 Signal Service stations and 15 Canadian stations, as telegraphed to this office; 145 monthly journals and 145 monthly means from the former, and 13 monthly means from the latter; reports from 31 Sunset stations; 240 monthly registers from Voluntary Observers; 26 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers in, and the local Weather Service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon chart No. II is shown the general distribution of the atmospheric pressure for the month, as reduced to sea-level, by the isobaric lines. The mean pressure for the present month, when compared with the average for December of the past seven years, is higher for the Atlantic States, Lake region, Minnesota and eastern Dakota, being greatest for New England—from 0.11 to 0.22 of an inch. It is about normal for Florida and California. For the remaining sections it is generally lower, especially in the Rocky Mountain regions. It varies from 0.14 of an inch below on Pike's Peak to 0.19 at Virginia City.

Local Barometric Ranges.—These have been least in Florida, New Mexico and southern California. They have been greatest over the western portions of Kansas and Nebraska, northwestern Dakota, Lake Superior, Maine, Idaho, and northern California. By districts they are as follows: New England, 1.01 to 1.40 inch; Middle Atlantic States, 0.83 to 1.12 inches; Lower Lake Region, 1.08 to 1.20 inch; Tennessee and the Ohio valley, 0.74 to 1.05 inch; Upper Lake Region, 1.04 to 1.54 inch; Upper Mississippi valley, 1.08 to 1.34 inch; Red River of the North Valley, 1.19 to 1.40 inch; Lower Missouri valley, 1.43 to 1.45 inch; Upper Missouri valley, 0.95 to 1.54 inch; Eastern Rocky Mountain Slope, 0.70 to 1.60 inch; Virginia City, 0.94 inch; Salt Lake City, 1.29 inch; Winnemucca, 1.16 inch; Boise City, 1.34 inch; Portland, Or., 1.25 inch; Central Pacific Coast region, 0.95 to 1.37 inch; Los Angeles, 0.75 inch; New Mexico, 0.64 to 0.79 inch; Western Texas, 0.56 to 1.58 inch; Western Gulf States, 0.74 to 1.15 inch; Eastern Gulf States, 0.71 to 0.77 inch; South Atlantic States, 0.59 to 0.87 inch; Key West, 0.32 inch.

Areas of High Barometer.—Of these eleven are described. Nos. IV, IX and X are the most interesting on account of the low temperatures accompanying them, especially No. IX.

No. I.—On the 1st this high area approached the Northwest from British America. Its progress southward was prevented by low-pressure, No. II, then advancing eastward; in fact it was forced to remain north of the Lake region on the 2nd. North of Pembina the temperature fell below zero. During the afternoon of the 3rd the barometers at Chatham, N. B., and Sydney, C. B., rose to 0.55 and 0.56 in., respectively, above the normal. On the following day it disappeared over the Gulf of St. Lawrence in advance of low No. II.

No. II.—It advanced southeastward on the 4th toward the St. Lawrence valley, with its southwestern side covering the Lake region. Morning of the 5th it covered the lower St. Lawrence valley and New England; a. m. barometer at Quebec, 30.56 in., or 0.61 in. above the normal; midnight at Sydney, 0.71 above. During the 6th it passed eastward as low pressure No. III approached.

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No. III—made its appearance in the extreme Northwest on the 7th. The morning minimum temperatures were below zero from northeastern Montana to northwestern Minnesota; -15° Fab. at Fort Stevenson, Dakota, and -29° at Humboldt, B. A. During the 8th it progressed eastward with the central highest pressure north of the Lakes. The a. m. minimum temperature at North Platte was -13° . It crossed the St. Lawrence valley on the 9th. The midnight barometer at Chatham was 30.69 or 0.86 in. above the normal. 10th—During the approach of low pressure No. V, it withdrew to the eastward.

No. IV.—On the 10th the pressure, which had been below the normal from the North Pacific coast east and southeast beyond the Mississippi valley, began increasing. By midnight it was highest in Dakota. 11th, a. m. barometer at Yankton, 0.39 above the normal; minimum temperatures below zero from Colorado and western Kansas to Montana, Dakota, Minnesota, and northwestern Wisconsin, and -23° at Fort Stevenson. Cold, high northerly winds, and at places gales marked its advance; on the Texas coast quite a severe "norther," with a maximum hourly wind velocity of 40 miles at Indianola. 12th, in the morning heavy frosts occurred over the interior of the Gulf States, and light frost at places along the coast. The central highest pressure moved from the Northwest to the Ohio valley by midnight. At Pembina the a. m. minimum temperature was -41° . During the 13th, with increasing central pressure, it moved to New England, Nova Scotia and Brunswick; midnight barometer at Chatham, 30.78 or 0.95 above the normal. Excepting the Pacific, Gulf and South Atlantic coasts, the morning minimum temperatures were below freezing, and below zero in the lower St. Lawrence valley. 14th, a. m. barometer at Halifax 30.80 or 0.96 above the normal. During the day it passed eastward beyond Nova Scotia, and the pressure rapidly decreased as low pressure No. IX advanced.

No. V.—From the 10th to the 15th the pressure continued considerably above the normal in the Middle Pacific Coast region. The central highest pressure was, apparently, at some distance off the coast and oscillating northward to the North Pacific coast, and southward to the South Pacific coast. On the 14th it extended southeastward, and on the 15th and 16th it gradually disappeared over Arizona.

No. VI—appeared night of the 13th in the extreme Northwest. The a. m. minimum temperature at Pembina on the 14th was -28° . It moved southward very rapidly during the day. Morning of the 15th it appeared as a narrow barometric ridge extending from the Red River of the North valley to Texas, with decreasing pressure and minimum temperature of -30° at Breckenridge. Upon this and the following days it gradually passed south and eastward across the Southern States, and disappeared off the South Atlantic coast.

No. VII.—Following low pressure No. X, it rapidly advanced southward from British America over the Northwest on the 16th, with brisk to high northerly winds and cold weather. Morning of 17th the barometer at Breckenridge read 30.66, or 0.43 above the normal. The a. m. minimum temperature was below zero from the northern portions of Iowa and Nebraska to Wisconsin, Minnesota, Dakota and Montana; -28° at Fort Keogh, -30° at Fort Buford, and -38° at Fort Garry. During the day it advanced southeastward to the Upper Mississippi valley, with the pressure slightly above 30.50 in. During the 18th it began breaking up as it passed eastward on account of the development of low pressure No. XI in the Rocky Mountain region. Morning of the 19th the pressure was highest in the South Atlantic States and St. Lawrence valley. The former was dissipated during the day, while the latter rapidly passed southeastward over Nova Scotia in advance of low pressure No. XII. Cautionary Off-shore signals were ordered on the morning of the 17th along the Texas coast for a "norther;" afternoon, for the New Jersey and northern North Carolina coasts. Morning of the 18th for the central North Carolina coast; afternoon, they were changed to Cautionary along the North Carolina coast. Excepting for the last section the Signals were only justified at scattering stations.

No. VIII.—The southern portion of this extensive high-pressure area was felt throughout the Northwest on the 19th, the centre having been in Manitoba. Morning of the 20th the minimum temperature at Pembina and Fort Garry was -40° ; barometer at Fort Garry, 30.71, and 0.47 above the normal at Duluth. As it moved eastward to the north of the lakes it produced cold weather from the Northwest eastward over the Lake region to the St. Lawrence valley and New England, with brisk to high northerly winds. 21st, a. m. minimum temperature generally below zero from New England to the northern portion of the Upper Lake region and -34° at Ottawa, Canada. By midnight it was central in the lower St. Lawrence valley; barometer at Father Point, 30.88, and 0.85 above the normal at Quebec. 22nd, as low pressures Nos. XIII and XIV approached it moved eastward beyond Nova Scotia.

No. IX.—The pressure began to increase throughout the Northwest on the 22nd, with cold weather. The midnight temperature at Humbolt, B. A., was -40° . 23rd, the advance of low pressure No. XVI caused it to divide into two portions, one of which moved over the Middle States, New England and the Gulf of St. Lawrence. The other advanced southward over the Northwest toward the Southwest, with high northerly winds and gales and very cold weather. On the morning of the 24th the minimum temperature was below zero from northern Indian Territory to western Wisconsin, Minnesota, Dakota, Montana, Idaho, the eastern portions of Washington Territory, Oregon, Nevada and probably northern portions of Arizona and New Mexico; at Dodge City, -10° ; Pioche, -13° ; Dayton, (Wash. Ty.), -17° ; Cheyenne, -24° ; Bismarck, -38° ; Pembina, -59° . Afternoon barometer at Breckenridge, 30.83, or 0.59 above the normal. During the day its advance reached the Texas coast as a severe "norther;" maximum hourly wind velocity at Indianola, 46 miles. In the North Pacific coast region the pressure rose to about 0.60 above the normal.

25th, the highest pressure was central over Indian Territory and eastern Oregon in the morning; minimum temperature, 29° at Yuma, -10° at Prescott, Arizona, and -13° at Santa Fé. Unusually cold weather prevailed from the Pacific coast to the Mississippi valley. In Texas and New Mexico it was particularly severe. Morning of the 26th, it was central in Texas. During this and the following days it gradually passed eastward over the Southern States, with diminishing central pressure.

No. X.—There were indications of the approach of this high area on the 28th from British America. At Battleford, ($52^{\circ} 41' N. 108^{\circ} 30' W.$) the temperature was reported as -44° . During the 29th it rapidly extended southeastward over the Northwest and Upper Lakes, with cold northerly winds. Minimum temperatures of -40° and -43° were recorded in the morning at Pembina and Fort Garry, respectively. On the 30th it moved toward the St. Lawrence valley, producing low temperatures in New York and New England; minimum, -38° at Rockliffe, Can. It passed over and beyond the Gulf of St. Lawrence on the 31st. Cautionary Signals were ordered for northerly winds on the North Carolina coast, and Off-shore Signals from New Jersey to Maine. They were generally justified. Warnings were sent for Nova Scotia, but too late.

No. XI.—The deviations of the barometric readings from the normal figures indicate that this high area crossed the Middle and South Pacific Coast regions on the 30th, and rapidly extended southeastward across the Plateau districts toward the Southwest. At midnight of the 31st, the pressure continued high from California to the Lower Ohio valley, and highest over southern Illinois.

Areas of Low Barometer.—Twenty-one areas of low barometer are described below. Of these, three have crossed the entire country from the Pacific to the Atlantic. Three came from the North Pacific coast and died out in the Rocky Mountain region; four from British America and to the westward of Manitoba; one developed in Texas; one off the Texas coast; one on the North Carolina coast; one over Chesapeake Bay; one on the coast of Maine.

No. I.—On the morning of the 1st, the pressure was below the normal from the Pacific coast eastward to the Northwest, and decidedly so in the North Pacific coast region. This disturbance passed northeastward, as shown on Chart No. I, accompanied by numerous light rains from the Pacific coast to Montana, but changing to snow in latter section.

No. II.—developed on the 1st from the same low pressure as No. I. By midnight the barometer at Omaha had fallen 0.31 in. below the normal, and snow was reported from Dakota to northern Michigan. During the 2nd, light rains and snow were frequent from the Lakes to the Northwest, with occasionally high northerly winds over the Upper Lakes. At night its progress eastward was very much delayed by the high pressure to the northward. 3rd, numerous light rains fell from the Gulf States to the Lakes and St. Lawrence valley, partly as snow in two last sections. An easterly gale prevailed in lower St. Lawrence valley. 4th, its movement over New England and the Gulf of St. Lawrence was very rapid, accompanied by rain to the southward, and by snow, with high northerly winds on its northern side. Maximum hourly wind velocities were recorded as follows: Pike's Peak, W. 54; Duluth, NE. 28; Escanaba, N. 30; Indianola, SE. 35; Quebec, E. gale; Father Point, E. 30 miles. Cautionary Signals were ordered, midnight of the 1st, to be displayed at the Stations along the Upper Lakes and Lake Erie, and warnings telegraphed to Toronto for the Canadian stations along Lakes Huron and Erie, but were only partly justified, over the northern portion of the Upper Lakes.

No. III.—crossed the North Pacific Coast region on the 2nd, producing southerly gales on coast, and rainy weather, thence to Idaho and the Northern half of California. The midnight barometer at Olympia was 0.46 below the normal. During the 3rd it passed into western Colorado, with cloudy and rainy weather from California, Nevada and Utah northward, turning to snow in Montana and Dakota. 4th, as it advanced toward the Mississippi valley, with threatening and rainy weather, partly as snow in Minnesota and Dakota, it increased in energy, and developed into a narrow barometric trough, reaching from Minnesota to Texas at midnight. Thunder-storms were frequent from Texas to the Lower Missouri valley. Before recovering the normal, the pressure again rapidly diminished on this date in the North Pacific Coast region; p. m. barometer at Olympia 29.45 or 0.65 below the normal. Rainy weather and high southerly winds prevailed from thence to Idaho, Nevada and Northern California. During the 5th this second disturbance rapidly advanced southeastward and united with the first, which explains the northeastward movement to Wisconsin, as shown upon the chart. Rainy weather accompanied them from the Southern States to the Upper Lake region, and partly as snow in the Northwest, and gales occasionally occurred. At Madison, Wis., the barometer fell to 29.30, and at La Crosse to 0.63 below the normal at midnight. 6th, as it passed into Canada the rain-area extended to New England, followed by clearing weather from the Southern States to the Northwest. Marquette a. m. barometer 29.27 or 0.66 below normal. 7th, the central depression apparently crossed the mouth of the St. Lawrence, with frequent gales thence to New York, New England and Nova Scotia. Maximum wind-velocities: Red Bluff, SW. 32; on Pike's Peak, W. 56; Indianola, NW. 40; Denison, S. 34; Fort Griffin, S. 40; Dodge City N. 40; North Platte, SE. 42; Cheyenne, W. 50; Breckenridge, SE. 34; St. Paul, SE., and Duluth, E. 32; Alpena, SE. 30; Erie, S. 30; Barnegat, SE. 32; Sandy Hook, NE. 32; Wood's Holl, SE. 40; Portland, SE. 34; Eastport, SE. 36; Father Point, W. 45; Mt. Washington, S. 84 miles. Morning of the 4th Cautionary Signals were ordered for Duluth; afternoon for the remaining stations on Lake Superior, those along Lake Michigan, the Texas coast, and Port Eads mouth of the Mississippi; midnight for Lakes Huron and Erie, and warnings for Canadian stations on Lakes Huron, Erie and Ontario. Morning of the 5th, for New Orleans, Mobile and Pensacola; midnight for Lake Ontario, Cedar Keys, Fla., and along the Atlantic from Florida to

Massachusetts, and warnings for Montreal, Quebec and Ottawa, Canada. Afternoon of the 6th, for the remaining portion of the New England coast, and warnings for the Canadian Maritime Provinces. On the morning of the 7th, those from New Jersey to Massachusetts were changed to Off-Shore Signals, and warnings despatched for Newfoundland. They were well justified, except from Florida to South Carolina.

No. IV.—The center of this low pressure rapidly passed southeast over Washington Territory on the 6th. The 7th it united with a depression in the Southwest, which had developed from storm No. III., and was slowly dissipated over Texas. Rainy weather accompanied it in the North Pacific coast region, changing to snow toward Utah and the Northwest, with high winds at places. In anticipation of increasing northeasterly winds, with snow, from southern Lake Michigan to Lake Erie, Cautionary Signals were ordered at midnight of the 7th, but lowered next morning, having been not justified.

No. V.—During the afternoon of the 7th, the pressure rapidly diminished over the northern half of California. By midnight the storm-center was between San Francisco and Red Bluff, with heavy rain and gales. Heavy snow fell in the northern portions of Nevada and California. Sacramento barometer 0.49 below the normal. 8th, the snow-area extended eastward into Dakota and Nebraska; a. m. barometer at Salt Lake City, 0.66 below normal. 9th, it advanced northeastward toward Wisconsin; the barometric gradients became quite steep, with resulting high winds and gales; a deep barometric trough formed to the southwest, in which, as the wind shifted suddenly from southerly to northerly, a tornado was caused at Renick, Mo., at 4 p. m. At midnight the rain-area extended from the central Gulf States to the Lakes and Northwest, partly as snow in last district. 10th, a. m. barometer at Duluth 29.17, or 0.82 below normal. Between 12 and 1 a. m. a tornado also occurred at Parker's Station, Scott Co., Mo. As the depression passed into Canada, rainy weather with frequently high winds and gales prevailed to the Gulf and Atlantic coasts, but clearing at night from the Southwest and Northwest to the Ohio valley. 11th, the center passed north of the mouth of the St. Lawrence, but with a deep trough extending southwestward toward the Gulf, in which heavy rains fell. Maximum wind velocities: San Francisco, S. 34; Sacramento, SE. 32; Pike's Peak, W. 44; North Platte, NW. 36; Fort Sill, S. 32; Indianola, N. 39; Bismarck and Pembina, N. 40; Breckenridge and Duluth, NW. 36; St. Paul, W. 40; Milwaukee, E. and W. 36; Alpena, SW. 36; Sandusky, SW. 38; Erie, S. 38; Saugeen, W. 45; Burlington, W. 35; Mt. Washington, SW. 84 miles. On the 9th and 10th thunder-storms occasionally occurred from Iowa, Wisconsin, Michigan and Ohio to Texas and Mississippi. Cautionary Signals were ordered midnight of the 8th for the Upper Lakes and Lake Erie. Morning of the 9th, for the Texas and North Carolina coasts, the latter in anticipation of increasing northeast winds in connection with high pressure No. III, while warnings were telegraphed for the Canadian stations on Lakes Huron, Erie and Ontario; afternoon, for Lake Ontario; midnight, for the New Jersey coast, and warnings for the St. Lawrence valley. Morning of the 10th, for Port Eads, Norfolk, Baltimore and the New England coast; midnight and following morning, warnings for New Brunswick and Nova Scotia. Afternoon of the 10th, they were changed to Off-shore at Indianola, Galveston and Port Eads; afternoon of the 11th, from New Jersey to Maine. The signals were fully justified. Those on the North Carolina coast were continued for several days on account of the northeasterly gales, produced by high pressure No. IV, as it passed eastward.

No. VI.—There was a slight depression which quickly passed southeastward over the North Pacific coast on the 9th, and died out over Utah on the 10th. It was accompanied by rainy weather along the Middle and North Pacific coasts, and snow thence toward Colorado and Wyoming.

No. VII.—The southern edge of this disturbance produced rain on the 11th along the North Pacific coast and snow thence to Utah and Montana. 12th and 13th, cloudy weather with generally light snow was reported from Nevada to Dakota, Montana and changing to rain toward Idaho and Washington Ty. On the latter date it apparently lost its identity southwest of the Lower Missouri valley. Maximum velocity on Pike's Peak, NW. 56 miles.

Nos. VIII and IX.—The former developed off the Western Gulf coast on the 13th, producing rainy weather in the Southern States with increasing northeasterly winds, and on the Texas coast northerly gales. 14th, by afternoon it appeared as a narrow barometric trough extending from the Upper Ohio valley southwest over Alabama into the Gulf, and by midnight it was central in western Pennsylvania. The latter rapidly formed in the morning over eastern North Carolina and moved northeast along the coast, causing northeasterly gales in advance of it. Heavy rains fell from the Lower Mississippi valley to the Atlantic coast and Lower Lakes, and changing to snow in the northern portions of New England and the Lake region. 15th, by midnight the two had united over the Gulf of St. Lawrence, with diminishing central pressure; Chatham 29.20, or 0.63 below the normal. During the day it was succeeded by clearing weather, except in the Lake region and St. Lawrence valley, where it cleared away at night. Maximum velocities: Indianola, N. 36; Cape May, NE. 32; Atlantic City, NE. 37; Barnegat, NE. 36; Sandy Hook, NE. 48; Boston, E. 30; Eastport, NE. 35; Duluth, N. 32; Sandusky, SW. 34; Buffalo, W. 37; Mt. Washington, SE. 84 and NW. 96 miles. Cautionary Signals which had been ordered on the 13th for the preceding disturbance along lakes Superior and Michigan, were continued as well as along the North Carolina coast. Morning of the 14th, they were ordered from New Jersey to Maine, and warnings sent for the Canadian stations in Nova Scotia and New Brunswick; afternoon for Lake Huron. Noon of the 15th, for Lake Erie; afternoon they were changed to Off-shore from North Carolina to New Jersey. Except over northern Lake Huron, they were generally justified, as shown by the preceding velocities. There was a failure to order signals for the Texas coast.

No. X.—On the 15th this disturbance advanced southeast from British America over the extreme Northwest, producing light snows and occasional high winds. 16th, a. m. barometer at Omaha 0.50 below normal. It passed eastward over the Lake region with diminishing energy, and snow fell from Idaho eastward over the Lake region. Maximum velocities: Umatilla, W. 32; Virginia City, W. 32; Cheyenne, W. 50; on Pike's Peak, W. 62; Sandusky, NW. 27 miles. Cautionary Signals were ordered morning of the 16th for the Upper Lakes, and warnings sent for Canadian stations on lakes Huron and Erie; afternoon, for Lake Erie; midnight, for the New Jersey coast (late.) For the larger number of stations the signals were not justified.

No. XI—slowly developed on the 17th east of the North Pacific coast. By midnight of the 18th the pressure at Boise City and Salt Lake City was 0.40 below the normal. It was accompanied by light rains along the Middle and North Pacific coasts, and snow thence toward Dakota. On the 19th, as storm No. XIII advanced it lost its identity, but sent out to the Southern States a slight depression. Afternoon of the last date signals were ordered for the New Jersey coast and partly justified.

No. XII—was a slight disturbance which developed over the Upper Lake region on the 19th. As it progressed eastward it was accompanied by numerous light snows. Cautionary Signals were ordered midnight of the 20th, for the New Jersey coast. Morning of the 21st, for the North Carolina coast. The latter were late. High northerly winds were produced along the coast from North Carolina to Nova Scotia, due to the advance of high pressure No. VIII, with a steep barometric gradient.

Nos. XIII and XIV.—The former was an unusually extensive and severe storm, and affected the entire country during its passage, except from Florida to South Carolina. During the day of the 18th the pressure, which had been left below the normal by low pressure No. XI, remained stationary, but at night, fell rapidly, with heavy rain in northern California. 19th, early in the morning southeasterly gales prevailed in the northern half of California, which during the day backed to southwesterly and extended to Nevada; in Oregon and part of Washington Territory, northeasterly gales. Rain became general in California, unusually heavy in northern portion, turning to snow toward Montana, Idaho and Washington Territory. By midnight the barometer at Red Bluff fell to 29.32, or 0.76 below normal. 20th, the rain-area extended to New Mexico and snow to Dakota, with high winds and gales at many points. 21st, its movement to the Lakes was very rapid, with generally light rains in Tennessee and the Ohio valley, but turning to snow, thence to the Northwest, Lakes and Middle States. 22nd, the main depression was gradually dissipated as it passed toward the St. Lawrence valley. No. XIV developed on the Middle Atlantic coast, and moved northeastward. The gradient became very steep, owing to the presence of high pressure No. VIII in front it, and northeast gales, with heavy snow resulted along the coast. During this and the preceding day thunder-storms occurred from Missouri, Illinois, Indiana and Iowa to Tennessee. Maximum velocities: San Francisco, SE. 36; Sacramento, S. 39; Red Bluff, SE. 52; Los Angeles, SE. 27; Winnemucca, SW. 45; Umatilla, NE. 52; Pioche, S. 36; Salt Lake City, SE. 31; Pike's Peak, SW. 68; North Platte, SW. 40; Dodge City, N. 40; Indianola, S. 31; Milwaukee, E. 41; Alpena, SE. 40; Erie, S. 36; Barnegat, E. 32; Sandy Hook, E. 44; Boston, N. 30; Eastport, NE. 37; Quebec, E. gale; Mt. Washington, NW. 84 miles. On the morning of the 21st, Cautionary Signals were ordered for Lakes Michigan, Huron and Erie; afternoon for Lake Superior, and warnings sent for Canadian stations on Lakes Huron and Erie; midnight for Lake Ontario, continued from North Carolina to New Jersey, and ordered up thence to Massachusetts, also warnings for Lake Ontario and St. Lawrence valley. Morning of the 22d, for coasts of New Hampshire and Maine, and warnings for Nova Scotia. These signals were fully justified. Off-shore Signals, ordered morning of the 22nd along the Texas coast for a "norther" were not justified.

Nos. XV, XVI and XVII.—The first crossed the North Pacific on the 21st, and Utah the 22nd. It was accompanied by rain along the Pacific coast, and by snow thence toward Utah. The barometric changes show that the second depression developed from the first and No. XIII, and appeared morning of the 23rd, in northeastern Texas. During the day as it progressed northeastward, threatening and rainy weather prevailed from the Western Gulf States to the Middle States, Lake region and Northwest, generally turning to snow in two last districts. 24th, the third developed on the New England coast, with rain and snow. Maximum velocities: Red Bluff, SE. 31; Winnemucca, SW. 34; Santa Fe, SW. 29; Ft. Sill, N. 40; Duluth, NW. 40; Alpena, E. 29; Wood's Holl, SW. 34; Eastport, E. 28; Mt. Washington, NW. 90 miles. Cautionary Signals were ordered, morning of the 23rd, for northern half of the North Carolina coast; afternoon, for New Jersey, Lakes Erie, Huron and Michigan, and warnings for Lakes Huron, Erie and Ontario; midnight, for Lake Superior, and Off-Shore Signals for a severe "norther" along the Texas coast. Morning of the 24th, for Lake Ontario and New England coast, and warnings for Nova Scotia. They were all lowered during the 24th, except on the Texas coast. Along the Lakes and southern New England coast they were justified at scattering stations, but in the other sections quite generally. During the 25th they were again hoisted from North Carolina to Maine, and in the afternoon changed to Off-Shore from New Jersey southward; also the remaining stations along the Gulf coast were ordered to display Off-Shore Signals. The latter were reported not justified; the former, justified, except at scattering stations in New England.

Nos. XVIII and XIX.—The southern edge of the former produced rain along the North Pacific coast, and snow thence to Idaho on the 26th, also occasional snow in the Upper Lake region. On the 27th it moved southwestward toward Kansas, under the influence of No. XIX, which was central over the North Pacific coast at midnight; Olympia, barometer 0.64 below the normal. The pressure was decidedly below the normal from the Pacific coast to the Northwest and Southwest. Threatening and rainy weather prevailed in the North and South Pacific coast regions, Arizona and western New Mexico. Snow occasional-

ly fell from Nevada to eastern Washington Territory, Idaho, Montana and Dakota. 28th, No. XIX lost its identity at night in the Rocky Mountain region, while No. XVIII moved toward the Lake region with increasing energy. Rainy weather accompanied it in the Pacific coast regions, Arizona, New Mexico and the Ohio valley, and frequent snow to the northward. At Leavenworth the afternoon barometer read 29.31, or 0.70 below the normal. 29th it rapidly passed northeast to the Gulf of St. Lawrence, leaving a narrow barometric trough extending southwestward to Texas, in which rains were frequent, partly turning to snow to the northward. Maximum velocities: Pike's Peak, SW. 56; Cheyenne, W. 44; Dodge city, SW. 45; Bismarck, E. 32; Duluth, NE. 28; Milwaukee, SW. 28. On Mt. Washington, W. 105 miles. Cautionary Signals were ordered morning of the 27th for Milwaukee, Grand Haven and Ludington, on Lake Michigan, (the display of signals being ceased at the other Lake stations) but reported as not justified. Warnings were also sent for the Canadian stations, on Lakes Huron Erie and Ontario and St. Lawrence valley. Signals were also ordered the 28th for the Texas coast and Eastport, but not justified; also, warnings for Lake Huron.

No. XX.—This disturbance was central north of Minnesota and Dakota, night of the 30th; its progress southeast over the Lower Lakes on the 31st was very rapid, accompanied by fresh to very brisk winds, except on Mt. Washington, where a hurricane velocity (the highest for the month) was recorded. Snow frequently fell from the Northwest and Lake region to the St. Lawrence valley and New England, and rain thence southwestward to New Mexico and the Southwest. Maximum velocities: Virginia City, N. 30; Pembina, S. 34; Cleveland, SW. 28; Mt. Washington, W. 111 miles. Cautionary Signals were ordered, 31st, from New Jersey to Maine, and warnings sent for the St. Lawrence valley. They were only justified at scattered stations.

No. XXI.—The centre of this storm passed eastward from the Pacific coast to the north of the limit of the Signal Service stations. On the 31st rainy weather prevailed along the North Pacific coast, while high southerly winds and gales were general from thence to Montana; at Portland, Or., S. 25 miles; at Forts Shaw and Assiniboine, Montana, southerly gales; North Platte, S. 33. Its subsequent history belongs to the January REVIEW.

INTERNATIONAL METEOROLOGY.

Three International charts, Nos. IV, V and VI, accompany the present *Review*. No. IV indicates the probable course of low pressure areas over the North Atlantic ocean and neighboring waters and continents during the month of *November*, 1879; it is based upon observations made on board of nearly 200 vessels, and which have been collected from various sources or received directly at this office up to January 5th, 1880. Nos. V and VI are charts for the month of *May*, 1878, and are based upon the International Simultaneous Observations, as described in the *Review* for July, 1879, supplemented by such other observations as have been considered specially applicable and trustworthy.

On chart No. IV the tracks of seventeen areas of low pressure, which, during a portion of their existence, were located over the North Atlantic Ocean or neighboring waters, are traced. Although the number of reports at present to hand is somewhat small, they are probably sufficient to enable a good idea to be formed of the meteorological conditions existing over the North Atlantic, between the 35th and 55th parallels, during the entire month. In the following resume only the above area will be referred to unless specially noted. The month opened with areas of low pressure central respectively to the north of Newfoundland and over Norway and Sweden; the former being a continuation of low area No. IX shown on chart No. I of the October REVIEW, while the latter had apparently advanced southeastwardly to the Norwegian coast. Areas of high pressure existed over the eastern portion of the United States, moving eastwardly, and over the eastern portion of the Atlantic, moving slowly southeastwardly. On the 1st brisk to high westerly winds or gales prevailed from 65° to 45° W., and light easterly winds from 35° W. to the Irish coast. On the 2nd the pressure rose over the west Atlantic and British Isles as the high areas moved eastward and the low area north of Newfoundland northward. Westerly gales and high seas continued in the vicinity of the Banks of Newfoundland, (bark Royal Arch was abandoned in 43° N. 59° W.,) but thence eastward light or moderate southerly to easterly winds. 3rd, area of highest pressure central over the eastern Atlantic to the west of Ireland and extending its influence over all western Europe; light easterly winds between 10° and 25° W.; southwest winds and rain about 50° N., 35° W.; pressure over western Atlantic rapidly diminishing in advance of low area No. II, (low area No. I, chart I, November REVIEW.) 4th, area of highest pressure central over Ireland, (Valentia, barometer 30.67 inches or 778.2 m. m., wind SW.;) light southerly winds thence to 40° W.; low area No. II moved rapidly northeastward during the night of the 3rd and 4th, accompanied by severe weather, with fierce squalls and heavy snow or rain, from Labrador to the Banks of Newfoundland; large area of high pressure over the eastern portion of the United States, moving eastward. 5th, area of high pressure over the east Atlantic, slowly moved southward, (Valentia barometer 30.69 or 779.5, wind calm,) while low area No. III advanced southeastward over Norway; southerly gales from 30° to 45° W., in advance of low area No. II; high or rising pressure over the west Atlantic, preceded by cold northwesterly winds and heavy snow off Cape Sable. On this day, 5th, two vessels were dismasted in a hurricane (low area No. IV) in 21° N., 27° W., which probably moved in a northerly direction on the 6th and 7th, and was encountered on the latter day in 30° N. 25° W. 6th and 7th, the center of highest pressure over the east Atlantic moved southward very slowly towards the Bay of Biscay, (barometer at

Valentia about 30.70 or 780.5, and at La Corogne and Bilbao, 30.55 or 774.7;) low area No. II moved northeastward, and southerly squalls or gales veering to west and north were reported from 20° to 45° W.; high pressures prevailed over the west Atlantic, with high or variable winds. 8th and 9th the area of high pressure previously existing over the east Atlantic moved eastward over Europe, followed over the British Isles and France by cloudy, dull or foggy weather, in advance of low area No. II, which moved rapidly northeastward to the Norwegian coast, with heavy rains in the north of Scotland; extensive area of high pressure advanced eastward, and on latter day apparently extended across the Atlantic. 10th, area of high pressure moved eastward, while low area No. V rapidly moved eastward to Newfoundland; as on the two preceding days, light to moderate winds prevailed over the Atlantic. 11th, area of high pressure moving slowly southeastward; area of low pressure No. VII appeared to the north of Scotland, while low area No. V moved to the east of Newfoundland, preceded by light southerly winds to 30° W. 12th, low area No. VII covered central Europe; small area of high pressure still remaining central over the east Atlantic, preceded by northwesterly gales over the British Isles and channel; low area No. V slowly advanced eastward to mid-ocean, with increasing energy, preceded by severe southerly gales between 30° and 35° W.: S. S. "*Leipzig*," (49° 53' N., 31° 44' W., at 7.35 a. m. Wash. time) reported, bar. 29.56 or 750.8, wind south, force 9, cloudy, heavy sea from south; S. S. "*Indiana*," (50° 34' N., 31° 40' W., 7.35 a. m., Wash. time,) bar. 29.36, SSE. 9, cloudy, heavy SSW. sea; in 38° N. 42° W. a northwest hurricane was reported lasting 36 hours, vessel hove to under bare poles for 12 hours. 13th, the small area of high pressure (about 30.30 or 769.6) over the east Atlantic, moved slowly southeastward toward the Bay of Biscay, while the low area, No. V, remained almost stationary, and with diminishing pressure at the centre, over mid-ocean; S. S. "*Leipzig*," (49° 4' N., 36° 40' W., 7.35 a. m., Wash. time,) bar. 29.43 or 747.5, wind N., force 7, cross seas from N. and S., cloudy with much hail; S. S. "*Indiana*," (49° 03' N., 38° 20' W., 7.35 a. m., Wash. time,) bar. 29.20 or 741.7, NNW. force 9, heavy NW., sea and cloudy; northwesterly winds prevailed thence to the banks of Newfoundland, and northeasterly backing to northwesterly winds off the Nova Scotia coast, as low area No. VIII moved southeastwardly. 14th, as low area No. VII continued its eastward march toward Russia the pressure rose rapidly over Norway and Great Britain, and including the small area over the Bay of Biscay, formed an extensive area of high pressure covering the whole of western Europe, accompanied by quite low temperatures and clear, frosty weather; southeasterly winds and rising temperature along the Spanish and Irish coasts; the low areas Nos. V and VIII, appeared to move southward and possibly formed an extensive area of low pressure to the westward of the Azores; severe northerly gales between 40° and 50° W.; small area of high pressure over Nova Scotia, moving eastward, during the day, over the Banks of Newfoundland, with diminishing pressure. 15th, high area over western Europe, moved southward, accompanied by quite low temperatures over England, France and northeastern Spain; low area No. V (and VIII?) central near the Azores (reports from the Azores not yet to hand) as a very severe storm; in 41° N. 36° W., the "*Warren Hastings*" was thrown on her beamends during a heavy northerly gale and sea, the man at the wheel was washed overboard and the vessel afterwards abandoned; in 27° N. 36° W., Bark "*Alida*" had heavy gale from WSW., lasting 36 hours; and several vessels afterward put into Fayal for repairs, having had bulworks stove, &c., during this storm. Falling pressure over the Banks of Newfoundland in advance of low area No. IX. 16th, highest pressures over western Europe, (30.59, or 776.9, at Ushant;) low pressure over the Atlantic, with centres of depression probably southwest of the Azores, (falling pressure and rough sea at Funchal,) and to the northeast of Newfoundland. 17th, high pressures over western Europe, (30.56, or 776.1, at Rochefort,) while a small area of low pressure passed eastward north of Scotland; falling pressure, with high southeasterly winds and rough sea at Funchal; low area No. IX to the northeast of Newfoundland, accompanied by SW. to NW. gales, high seas and heavy rain, from 30° to 45° W., in about 51° N.; rising or high pressures and northerly winds thence to the coast of the United States. 18th, high pressures continued over western Europe, (30.46 inches or 773.6 mm. at Bordeaux; high southeasterly winds, falling barometer and high sea at Funchal; low area No. IX probably central about 55° N., 30° W., with increasing southwesterly winds to the southward; higher pressures and light variable winds thence to the Banks of Newfoundland; low area No. X rapidly moved northeastward from Cape Henry to south of Cape Sable as a very severe storm. S. S. "*Leipzig*," (on the 18th, at 7.35 a. m., Washington time in 43° 1' N., 59° 46' W., and 19th, same time, in 41° 42' N., 64° 40' W.) reports 18th, 8 p. m., rapidly increasing SE. wind and sea, with heavy rain, barometer falling rapidly to 29.476 or 748.8; 19th, 3:00 to 3:20 a. m., fog; 6:30 a. m., wind shifting to NNE., with rapidly increasing northerly sea and rising barometer. 19th, high pressures over the whole of northern Europe, (30.57 or 776.4 at Stockholm, and 30.40 or 772.2 at Mullaghmore;) rapidly falling pressure over Spain and at Funchal, with continued high SSE. winds and rough sea at latter place; low area No. X rapidly moved eastward, accompanied by severe weather to 30° W., but it is hardly possible to locate its center for that day, owing to the large depression which existed over that portion of the Atlantic at the time. Low area No. XI moved northeastward at some distance off the coast of the United States as a very severe storm; it was described as low area No. XII, chart No. I, November REVIEW. 20th, highest pressure over northern Europe, (Stockholm, 30.75 or 781.1 mm;) extensive area of low pressure over the east Atlantic, and rapidly falling pressure over the whole of western Europe, with the center of depression probably near Funchal; steamer Roscommon is reported to have capsized and foundered at 1.20 p. m., in 37° 40' N., 24° 12' W. Low area No. XI moved rapidly over Nova Scotia as a very severe storm, the accompanying gales extending eastward to 37° W. 21st, the two large areas of low pressure over the Atlantic were probably central near Funchal,

where the wind had shifted to a NNW. gale, with very high seas, and to the north of Newfoundland, separated by a ridge of higher pressure over mid-ocean; southerly to westerly gales attending the latter depression prevailed south and eastward to 38° N. and 40° W. On the night of the 20th a very severe "norther," accompanied by heavy rains, commenced at Aspinwall, C. A., which, according to reports, continued with great violence to the 24th, doing an immense amount of damage to shipping, wharves and railroad stock. 22nd, rising pressure over the Atlantic between 40° and 50° N., with easterly to southerly winds from the European coast to 40° W., and brisk to high westerly winds, gales and high seas thence westward to the American coast; at Funchal the wind returned to the south. A subsidiary area of low pressure No. XIII moved from near Cape Lizard, England, northeastward. 23rd, pressure probably about normal over the east Atlantic, with gentle or moderate winds; a large area of low pressure existed, however, to the southwest of Funchal, where high SSE. winds and rough seas continued; in $22^{\circ} 35'$ N. $18^{\circ} 40'$ W., bark "Janet" was abandoned during a gale from SW. to SSW. The record of this vessel in reference to the meteorological conditions over this part of the Atlantic is interesting; on the 7th, in $30^{\circ} 30'$ N. $24^{\circ} 40'$ W., the captain reports "a very heavy gale from the SE., which hauled to NW., (see area No. IV.) vessel was hove down, lost portions of rigging, &c., and had decks swept; after gale, tried to make Canary Islands, but the wind coming out ahead, had to keep vessel south; went along at about 200 miles a day and hoped to get the NE. trades but there were none;" vessel abandoned on 23rd as above. An extensive area of high pressure, (30.40 or 772.2 at St. Johns, Newfoundland,) covered the western Atlantic, and light to moderate winds prevailed from Valentia to the American Coast. 24th, large area of depression to the westward of Funchal, where fresh southerly winds and rough sea prevailed, while in $34^{\circ} 27'$ N., $28^{\circ} 51'$ W., a NE. gale and heavy sea were reported, during which, Bark "Olive" was abandoned, the crew being taken on board U. S. S. Constellation. The large area of high barometer moved eastward and rapidly extended its influence to Great Britain and Norway, with northerly to easterly winds, thence over the Atlantic to 45° W. An area of low pressure, (No. XIII, chart I, Nov. Rev.,) moved northeastward over Newfoundland with stormy weather, followed by a high-pressure area off the coast of the United States. 25th, large area of high pressure over northern Europe, (Stornoway, 30.50 or 774.7, and Stockholm, 30.66 or 778.7;) large area of low pressure between the Azores and Canary Islands, (Funchal, 29.57 or 751.0, SSE. winds and very high sea;) rising and moderately high pressures with light winds over the west Atlantic. 26th, high but falling pressure over northern Europe and northern part of the Atlantic, (Mullaghmore, 30.41 or 772.4;) with easterly winds from Valentia to 45° W.; large area of low pressure near the Maderia Islands, (Funchal, 29.34 or 745.1, S. gale and high sea;) secondary depression, No. XVI, formed over the western Mediterranean; low area, No. XV, to the north of Newfoundland, moving eastward; higher pressures and northwesterly winds thence south and westward. 27th, large depression, central over the Atlantic north of Funchal, extending eastward over Spain and the western Mediterranean; high area to the northwest of Ireland, gradually diminishing in extent and pressure, with easterly winds from Valentia to 35° W.; low area No. XV probably moved southeastward, but with little energy, as shown on chart; rising pressure over Newfoundland and southward, with northwesterly winds extending eastward to 50° W. 28th, area of low pressure passed eastward over Spain, while the small area of high barometer to the west of Ireland diminished in extent and pressure. At Funchal the wind changed to N. high, with rising pressure and moderating sea; easterly winds prevailed from the Irish and French coasts to 35° W., which increased to a fresh gale in 47° N., 15° W.; low area No. XV was probably central near 45° N., 40° W., but without much energy; high pressure and light winds over the western Atlantic. 29th and 30th, area of lowest pressure over the Mediterranean; high pressures north of 50° N. from 15° to 45° W., with easterly winds near that parallel; low area No. XV probably central about 40° N., 40° W., but with little energy; low area No. XVI, chart I, November REVIEW, moved eastward north of Newfoundland on the 30th, followed by high pressures on the American coast.

TEMPERATURE OF THE AIR.

The general distribution of temperature for the month is shown by the isothermal lines and figures upon chart No. II. Upon the right side of the same chart, will be found a table, giving the average temperature by districts, for December, for several years and of this year. From New England, the Lower Lake region and Ohio valley, southwestward to the Gulf and southeastern Rocky Mountain Slope, and for Boise City, Idaho, the average is higher than usual, the greatest difference being for the South Atlantic States. At Salt Lake City it has been normal. In all the other districts it has averaged lower than usual, especially in the Missouri and Red River of the North valleys.

Minimum Temperatures.—Maine: -26° at *Orono and -15° at Eastport. New Hampshire: -26° on Mt. Washington and -14° at *Grafton. Vermont: -28° at Newport and -19° at Burlington. Massachusetts: -6° at *Amherst and 0° at Boston, and Springfield. Rhode Island: 7° at Newport. Connecticut: 2° at *Mystic and 4° at New Haven. New York: -24° at *Madison Barracks and *Schroon Lake, -20° at *Plattsburg Barracks, -7° at Oswego, 1.05 at Buffalo and 11 at New York City. Pennsylvania: -7° at *Dyberry, 3° at *Catawissa, 5° at Pittsburg and 11° at Philadelphia. Delaware: 18° at *Dover. Maryland: 6° at *Emmitsburg and 13° at Baltimore. District of Columbia: 13° at Washington. Virginia: 10° at *Wytheville and 25 at Norfolk. West Virginia: 7° at *Helvetia and 18° at Morgantown. North Carolina: 8° at *Highlands, 24° at Wilmington and 33° at Cape Hatteras. South Carolina: 26° at *Aiken and 34° at Charleston. Georgia: 17° at Atlanta and 33° at Savannah. Florida: 28° at Pensacola, 36° at

Cedar Keys and Jacksonville, and 68° at Key West. *Alabama*: 16° at *Green Springs and 24° at Mobile. *Mississippi*: 18° at *Fayette and 19° at Vicksburg. *Louisiana*: 18° at Shreveport and 32° at New Orleans. *Texas*: —10° at Fort Elliott, 2° at Pilot Point and Graham, 9° at Denison and Mason, 10° at Stockton and Uvalde, 27° at Brownsville and Rio Grande, and 24° at Galveston. *Ohio*: —15° at *Wooster, —1° at Cleveland, 5° at Columbus and 11° at Cincinnati. *Kentucky*: 12° at Louisville. *Tennessee*: 11° at *McMinnville and Knoxville. *Arkansas*: 10° at *Mt. Ida and 16° at Little Rock. *Michigan*: —14° at Escanaba, —9° at Marquette, —5° at Alpena, —2° at Detroit and Port Huron, —3° at *Lansing and 6° at Grand Haven. *Indiana*: 2° at *Wabash, 5° at Indianapolis and 9° at *New Harmony. *Illinois*: —16° at *Riley and *Belvidere, —2° at Chicago and 12° at Cairo. *Missouri*: —17° at *Oregon, —11° at *Kansas City and —1° at St. Louis. *Kansas*: —16° at *Fort Wallace, —13° at Dodge City and —8° at Leavenworth. *Wisconsin*: —32° at *Neillsville, —26° at La Crosse, and —12° at Madison and Milwaukee. *Iowa*: —35° at *Cresco, —27° at *Vail, —19° at Dubuque and —16° at Des Moines. *Nebraska*: —37° at *Fort Sydney, —27° at North Platte and *Genoa, and —17° at Omaha. *Indian Territory*: 2° at Fort Sill and 4° at Fort Gibson. *Minnesota*: —40° at Breckenridge, —39° at St. Paul and —34° at Duluth. *Dakota*: —59° at Pembina, —46° at Fort Buford and Fort Keogh, —38° at Bismarck, —34° at *Olivet and —16° at Deadwood. *Colorado*: —31° on summit of Pike's Peak, —19° at *Fort Garland and —17° at Denver. *New Mexico*: —22° at *Ft. Union, —13° at Santa Fé and 16° at La Mesilla. *Wyoming*: —34° at *Ft. Fred Steele and —24° at Cheyenne. *Utah*: —22° at *Coalville and —10° at Salt Lake City. *Nevada*: —20 at Winnemucca, —13° at Pioche and —11° at *Carson City. *Arizona*: —18° at Prescott, —2° at Apache, 0° at Phoenix and 27° at Yuma. *Idaho*: —30° at *Ft. Hall, and —4° at Boise City. *Montana*: —36° at Virginia City. *California*: 15° at San Geronimo, 25° at Red Bluff, Sacramento and Princeton, 32° at San Diego and 34° at San Francisco. *Oregon*: —14° at Umatilla, 3° at Portland and 7° at Roseburg. *Washington Ty.*: —17° at Dayton and 10° at Olympia. In northern New York and New England, the minimum temperatures occurred on the 21st and 22nd, accompanying high pressure No. VIII. In all the other sections they accompanied high pressure No. IX, and prevailed as follows: From the North Pacific coast to Dakota, on the 23rd and 24th; from the Middle and South Pacific coasts to Minnesota, Iowa, Kansas, Indian, Ty. and New Mexico, on the 24th and 25th; from Texas to the Upper Lakes, Lake Erie, Ohio valley and Tennessee, on the 25th and 26th; from the Gulf States to the Middle States, except in northern New York, on the 26th and 27th.

Maximum Temperatures.—*Maine*: 55° at *Surry and Portland. *New Hampshire*: 52° at *Grafton and 40° on Mount Washington. *Vermont*: 53° at *Charlotte and 54° at Burlington. *Massachusetts*: 63° at Boston and *Newburyport and 55° at Springfield. *Rhode Island*: 58° at Newport. *Connecticut*: 60° at *Mystic and New London. *New York*: 64° at *Brookhaven, 44° at *Plattsburg Barracks, 58° at Buffalo and 62° at New York City. *Pennsylvania*: 63° at *Fallsington, and 61° at Philadelphia, *Chambersburg and Pittsburgh. *Delaware*: 62° at *Dover. *Maryland*: 63° at Baltimore, *Fallston and *Emmitsburg. *District of Columbia*: 64° at Washington. *Virginia*: 79° at *Johnsontown, 74° at Cape Henry and *Accotink, and 55° at *Walnut Grove. *West Virginia*: 66° at Morgantown and 65° at *Helvetia. *North Carolina*: 78° at Wilmington, 68° at Cape Lookout and 59° at *Highlands. *South Carolina*: 75° at *Aiken and Charleston. *Georgia*: 80° at *Forsyth, and 76° at Savannah and Augusta. *Florida*: 86° at *Houston, 83° at Key West, 79° at Jacksonville and 75° at Pensacola. *Alabama*: 76° at Montgomery and 74° at Mobile. *Mississippi*: 78° at Vicksburg and *Brookhaven. *Louisiana*: 83° at *Lake Charles and 78° at New Orleans. *Texas*: 83° at Eagle Pass, 80° at Brownsville, 79° at Indianola and 76° at Denison. *Ohio*: 68° at *Ringgold, 66° at Cincinnati, and 62° at Columbus and Cleveland. *Kentucky*: 67° at Louisville. *Tennessee*: 72° at Chattanooga, and 68° at *McMinnville and *Ashwood. *Arkansas*: 73° at Little Rock and 70° at *Mount Ida. *Michigan*: 59° at *Niles and Detroit, 58° at Grand Haven, *Battle Creek and *Lansing, and 44° at Marquette. *Indiana*: 67° at *Vevay and 64° at Indianapolis and *New Harmony. *Illinois*: 66° at Cairo, 65° at *Anna, and 62° at Chicago and *Peoria. *Missouri*: 67° at *Craig, 65° at *Kansas City, *Oregon and *Pierce City, and 63° at St. Louis. *Kansas*: 78° at *Creswell, 70° at Dodge City and 63° at Leavenworth. *Wisconsin*: 57° at *Beloit and Milwaukee, and 44° at La Crosse. *Iowa*: 58° at *Glenwood and Keokuk, and 52° at Des Moines. *Nebraska*: 70° at *Fort Sydney, 57° at North Platte and 54° at Omaha. *Indian Territory*: 75° at Fort Sill and 69° at Fort Gibson. *Minnesota*: 40° at St. Paul, 38° at Duluth and 35° at Breckenridge. *Dakota*: 50° at Deadwood, 47° at *Olivet and *Morriston, 42° at Fort Keogh, 36° at Bismarck and 28° at Pembina. *Colorado*: 66° at Denver and *Fort Lyon, 49° at *Fort Garland, and 23° on summit of Pike's Peak. *New Mexico*: 73° at La Mesilla, 71° at *Fort Union and 53° at Santa Fé. *Wyoming*: 57° at Cheyenne and 47° at *Fort Fred Steele. *Utah*: 52° at Salt Lake City and 48° at *Coalville. *Nevada*: 66° at *Carson City, and 55° at Pioche and Winnemucca. *Arizona*: 74° at Yuma, Florence and Tucson, and 61° at Prescott. *Idaho*: 59° at Boise City and 48° at *Fort Hall. *Montana*: 44° at Virginia City. *California*: 76° at Los Angeles, 71° at San Diego, 64° at San Francisco and 63° at Sacramento. *Oregon*: 56° at Roseburg.

Those stations marked with a star (*) have been reported by Voluntary Observers, or U. S. Army Post Surgeons.

Ranges of Temperature at Signal Service stations.—The monthly ranges will appear from an examination of the Maxima and Minima just given. The greatest daily ranges vary in New England from 27° at Thatcher's Island to 47° at Eastport; Middle Atlantic States, 24° at New York, Cape May and Baltimore to 38° at Albany; South Atlantic States, 25° at Kittyhawk and 28° at Jacksonville to 37° at Atlanta; Eastern Gulf States, 12° at Key West and 26° at Cedar Keys to 34° at Pensacola, Mobile and New Orleans;

Western Gulf States, 29° at Little Rock and 35 at Vicksburg to 46° at Indianola; Ohio valley and Tennessee, 25° at Louisville and 29° at Morgantown to 44° at Memphis and 50° at Chattanooga; Lower Lake region, 25° at Detroit and 26° at Erie to 37° at Oswego; Upper Lake region, 21° at Grand Haven and 28° at Alpena to 35° at Duluth; Upper Mississippi valley, 30° at Keokuk and 38° at St. Paul to 42° at Des Moines; Red River of the North valley, 36° at Breckenridge and Pembina; Missouri valley, 31° at Omaha to 40 at Bismarck and 42° at Ft. Buford; Texas, 37° at Mason to 40° at Davis, 45° at Rio Grande, Concho and Brackettsville, and 67° at Ft. Elliott; Eastern Rocky Mountain slope, 24° at Dodge City and 34° at Ft. Gibson to 51° at North Platte; Rocky Mountains, 35° at Socorro to 41° at Virginia City, 46° on Pike's Peak and 61° at Denver; Northern and Middle Plateau Districts, 22° at Boise City to 27° at Pioche and 30° at Winnemucca; California, 14° at San Francisco to 28° at Visalia, 29° at Red Bluff and 33° at Los Angeles.

Frost was reported very generally from all States and Territories north of the 35th parallel. In Florida on the 16th, 17th, 18th, 26th and 28th, in the remaining states of the East Gulf, 1st, 6th, 7th, 12th, 13th, 15th to 18th, 25th to 28th. West Gulf States, 1st, 3rd, 7th, 11th to 19th, 21st, 24th to 27th; at Lake Charles, La., 25th, "intensely cold, all tender vegetation killed, a thing never known in this section before." Indian Territory, 1st, 3rd, 5th, 6th, 7th to 20th, 24th, to 31st. Arizona, 10th, 16th, 18th, 23rd to 31st, very heavy. California, 2nd, 3rd, 4th, 6th, 7th, 8th to 12th, 14th to 18th, 21st to 31st; at Los Angeles, on the 25th, plants and vegetables in many localities entirely destroyed.

Ice formed generally throughout the northern sections of the country, as will be seen by reference to the chapter on Navigation. In the Eastern Gulf States it formed on the 24th, 25th, 26th and 27th; Western Gulf States, 12th, 13th, 25th, 26th and 27th; Texas and Indian Territory, 6th, 12th, 13th, 14th, 24th, 25th, 26th and 27th. California, at San Francisco, on the 24th; Los Angeles, 25th; Visalia, 23d and 25th; Red Bluff, 23d, 24th, (25th 2½ inches;) Sacramento, 23d, 24th and 25th; Hooker's Lake, below the city, frozen over sufficiently solid for skating—first time in twenty-five years. On the 25th the water pipes in the city frozen up. Washington, 25th, shallow water ponds frozen over.

Ground Frozen.—Lompoc, Cal., 24th, ½ inch, 31st; Lake Charles, La. 25th; Brookhaven, Miss., 26th and 7th; Melissa, Tex., 11th; Sacramento, Cal., 23rd, 24th and 25th; Red Bluff, Cal., 24th and 25th; Visalia, Cal., 23d and 25th; Prescott, Ariz., 25th; Keokuk, Ia., ground remained frozen throughout the month.

The following notes are of interest as indicating the *excessive cold* of the month, in various sections:—Logan, Ia., 19th, -20°, the coldest day, at noon, in the past twenty years; Melissa, Tex., 24th, 12:15 p. m., heavy north wind, with snow and sleet, freezing as it fell; chickens were frozen fast to limbs of trees; ice formed on tanks to the depth of three inches, and the snow formed a crust so firm and hard that a horse's hoof made no impression. Coalville, Utah, 24th, -22°, coldest day in fourteen years. Humboldt Wells, Broncho and Truckee, Cal., 26th, excessively cold, mercury frozen. Prescott, Ariz., 25th, -18°, supposed to be the lowest temperature ever known in the territory. Virginia City, Montana, 24th, 1,500 sheep frozen to death and several herders badly frozen; 23rd to 26th, ranchmen reported a storm of wind and snow of unprecedented severity, all mails stopped and several mail-coaches lost. North Platte, Dak., 11th, mail-carrier frozen to death; 24th, -32°, coldest ever known here. Bismarck, Dak., 24th, -38°, lowest temperature ever recorded at this station. Breckenridge, 13th, two children and one man frozen to death. San Antonio, Tex., 25th, many cattle and sheep have died in this section from excessive cold. Boerne, Tex., 25th, 26th, most extreme cold for many years; telegraph battery frozen solid. Brackettsville; Tex., 25th, telegraph battery frozen solid. Brownsville, Tex., 25th, many sheep have perished from excessive cold. Pembina, Dak., heavy "blizzard" from the northwest, accompanied by a blinding snow-storm, blocking highways and obstructing railway communication.

PRECIPITATION.

The general distribution of the rain-fall, (which includes melted snow,) will be found upon chart No. III, as accurately as it has been possible to illustrate the same. The data has been taken from the reports from nearly five hundred stations. Upon the left side of the chart is given a table of average precipitation for December. An examination of the same will show that there has been an excess in California, the Missouri valley, Minnesota, Eastern Gulf States, Middle Atlantic States, New England, St. Lawrence valley, Lake region, Ohio valley and Tennessee; greatest in the last section, where it amounted to nearly five inches, and least in the Eastern Gulf States. In the other districts there has been a deficiency; least in the Upper Mississippi valley, and greatest in the Western Gulf States, where over two inches less than the average has fallen.

Special Heavy Rains.—5th, *White Plains, N. Y., 5th and 6th, 4.45 in.; *Ft. Barrancas, Fla., 5.43 inches in 5 hrs and 20 min.; Yreka, Cal., 3.54 in. 6th, *Fayetteville, N. C., 3.00 in. 10th, *McMinnville, Tenn., 10th and 11th, 2.50 in.; *Austin, Tenn., 9th and 10th, 2.62; *Ft. Barrancas, Fla., 1.74 inches in 3 hrs and 40 min.; Memphis, Tenn., 9th and 10th, 3.50 in.; Helena, Ark., 9th and 10th, 3.32 in.; Paducah, Ky., 9th and 10th, 3.99 in. 11th, Knoxville, Tenn., 2.46 in.; Chattanooga, Tenn., 10th and 11th, 3.10 in.; *Brookhaven, Miss., 10th and 11th, 2.30 in.; *Ft. Barrancas, Fla., 2.33. 13th, *Gainesville, Ga., 13th, and 14th, 4.40 in.; *Dover Mines, Va., 13th and 14th, 3.20 in.; *Forsyth, Ga., 13th and 14th, 3.15 in.; *Lenoir, N. C., 13th and 14th, 3.30 in.; *Franklin, N. C., 13th and 14th, 3.20 in.; *Highlands, N. C., 13th and 14th, 3.85 in.; *White Plains, N. Y., 13th and 14th, 2.20 in. 14th, Montgomery, Ala., 2.66 in.; Atlanta, Ga., 3.76 in.; Charlotte, N. C., 2.38 in.; Lynchburg, Va., 2.98 in.; Sandy Hook, N. J., 2.45 in.; *Ft. Barrancas,

Fla., 2.33 in. 19th, Red Bluff, Cal., 5.04 in.; *Lompoc, Cal., 18th and 19th, 3.62 in.; *San Geronio, Cal., 19th and 20th, 4.24 in. 20th, *Austin, Tenn., 2.30 in.; Los Angeles, Cal., 4.19 in.; 21st, *White Plains, N. Y., 2.00 in. 22nd, Knoxville, Tenn., 22nd and 23rd, 2.81 in. 23rd, *Laconia, Ind., 23rd and 24th, 3.80 in. 24th, *Vevay, Ind., 2.50 in.; *College Hill, Ohio, 24th, 25th, 2.75 in.; *McMinnville, Tenn., 24th and 25th, 3.75 in.; Morgantown, W. Va., 24th and 25th, 2.57 in.; *Austin, Tenn., 22nd to 24th, 4.25 in.; Evansville, Ind., 3.00 in. 25th, *Murphy, N. C., 24th and 25th, 3.40 in.; Paducah, Ky., from 22nd to 25th, 6.69 in. 27th, *San Geronio, Cal., 26th to 28th, 4.20 in. 30th, *Northport, Mich., 30th and 31st, 3.75 in. 31st, Paducah, Ky., 30th and 31st, 4.51 in.

Largest Monthly Rain-falls, including Melted Snow.—Paducah, Ky., 20.12 inches; * Ft. Barrancas, Fla., 15.46; *White Plains, N. Y., 12.60; Olympia, Washington Ty., 11.42; *Northport, Mich., 10.32; *Austin, Tenn., 10.20; Red Bluff, Cal., 9.95; *Ashwood, Tenn., 9.60; *Highlands, N. C., 9.40; *San Geronio, Cal., 9.39; Nashville, 9.15; *Evansville, Ind., 8.97; *Gainesville, Ga., 8.75; Memphis, 8.51; Chattanooga and *McMinnville, Tenn., 8.47; *Murphy, N. C., 8.30; Knoxville, 8.28; *Fayetteville, N. C., 8.25; *Laconia, Ind., 8.21; Sandy Hook, N. J., 8.02; Louisville, 7.93; Roseburg, Or., 7.86; Atlanta, 7.84; *Vevay, Ind., 7.60; Montgomery, 7.42; *Grafton, N. H., 7.40; Portland, Or., 7.36; *Trenton, N. J., 7.25; Cincinnati, 7.11; *Freehold, N. J., 6.77; *St. Meinrad, Ind., 6.66; Morgantown, 6.70; Barnegat, 6.68; Cairo, 6.63; *Franklin, N. C., 6.60; Los Angeles and *Quebec, 6.53; Vicksburg, 6.45.

Smallest Monthly Rain-falls, including Melted Snow.—Fort Davis and Stockton, Tex., none; Socorro, N. M., 0.01 inches; Laredo, Tex. and *Fort Sidney, Neb., 0.06; Uvalde, Tex., 0.09; Fort Elliott, Tex., 0.10; Dodge City and *Fort Union, N. M., 0.12; Pilot Point, Tex., 0.13; Cheyenne, 0.17; Concho, Tex., 0.18; *Gulf Hammock, Fla., 0.20; Castroville, Tex., 0.23; El Paso, Tex., 0.24; *Fort McPherson, Neb., 0.26; Yuma, Ariz., 0.27; Eagle Pass, Tex., 0.29; Denver, 0.33; Coleman, Tex., 0.34; North Platte, 0.37; Berne, Tex., 0.39; Fort Sill, 0.45; Jacksonville, 0.46; Mason and San Antonio, Tex., 0.47; Silver City, N. M., 0.49; Fort McKavett, Tex., and Santa Fe, 0.50; Fort Griffin, Tex., 0.51; Punta Rasa and Mayport, Fla., 0.52.

Rainy Days.—The number of days on which rain or snow has fallen, varies as follows:—New England, 9 to 26; Middle Atlantic States, 11 to 20; South Atlantic States, 8 to 15; Eastern Gulf States, 6 to 14; Western Gulf States, 7 to 14; Lower Lake region, 21 to 26; Upper Lake region, 15 to 24; Ohio valley and Tennessee, 14 to 23; Upper Mississippi valley, 11 to 22; Missouri valley, 8 to 16; Red River of the North valley, 8 to 11; Eastern Rocky Mountain Slope, 3 to 16; Texas, 0 to 11; Rocky Mountains, 1 to 15; Middle Plateau, 9 to 20; California, 9 to 12; Oregon, 21 to 26.

Cloudy Days.—The number varies in New England from 12 to 23; Middle Atlantic States, 10 to 20; South Atlantic States, 5 to 14; Eastern Gulf States, 1 to 14; Western Gulf States, 10 to 17; Lower Lake region, 18 to 29; Upper Lake region, 12 to 26; Ohio valley and Tennessee, 10 to 24; Upper Mississippi valley, 11 to 19; Missouri valley, 9 to 15; Red River of the North valley, 12 to 15; Eastern Rocky Mountain Slope, 7 to 11; Texas, 2 to 12; Rocky Mountains, 1 to 14; Middle Plateau, 5 to 22; California, 8 to 12; Oregon, 21 to 27.

Hail was reported from the various states on the following days: Pennsylvania, 31st; Virginia, 21st; Ohio, 19th, 24th; Missouri, 19th, 20th, 30th; Kansas, 9th, 30th; Indian Territory, 4th, 30th; Texas, 4th, 5th, 24th.

Snow fell on the following dates in the various districts: New England, 2nd, 3rd, 6th to 31st. Middle Atlantic States, 8th, 9th, 10th, 13th to 31st. Ohio Valley, 6th, 7th, 8th, 12th to 26th, 28th to 31st. Tennessee, 25th. Lower Lake region, 6th, 8th, 9th, 11th to 31st. Upper Lake region, 1st to 4th, 6th to 9th, 11th to 31st. Upper Mississippi valley, 1st to 11th, 13th to 31st. Missouri Valley, 1st to 23rd, 25th, 27th, 28th, 30th. Mississippi, at Vicksburg, 25th, 26th. Louisiana, at Shreveport, 25th. Texas, northeastern quarter, 13th, 24th. Arkansas, Little Rock, 24th. Indian Territory, 20th, 24th, 30th. Rocky Mountains, 3rd to 14th, 16th to 25th, 27th to 30th. Arizona, 23rd, 24th, 27th, 28th, 29th. Western Plateau, 3rd to 5th, 7th to 13th, 18th to 23rd, 26th to 30th. California, Red Bluff, 28th. San Geronio, 21st, 22nd, 28th, 29th. Washington Territory, 5th, 6th, 8th to 12th, 17th to 22nd, 25th.

Largest Monthly Snow-falls.—Marquette, 56.50 inches; Mt. Washington, 54.50 in.; Oswego, 44.50 in.; Duluth, 39.25 in.; Virginia City, 38.50 in.; *Northport, Mich., 37.75 in.; Alpena, 32.50 in.; *Grafton, N. H., *Newport, Vt., and Buffalo, 29.00 in.; Pike's Peak, 27.00 in.; *Rowe, Mass., 25.50 in.; *Strafford, Vt., 25.00 in.; St. Paul, 23.00 in.; Pembina, 22.00 in.; *Cornish, Me., 21.00 in.; *Antrim, N. H., 19.50 in.; *Palermo, N. Y., 19.25 in.; *Orono, Me., 19.00 in.; *Neillsville, Wis., 18.50 in.; *Little Mountain, Ohio, 18.00 in.; *Coalville, Utah, 17.75 in.; Ft. Buford, Dak., 16.80 in.; *Nora Springs, Iowa, *Clinton, Mass., and Milwaukee, 16.50 in.; *Argyle, N. Y., and Winnemucca, 15.50 in.; *Newburyport, Mass., 13.75 in.; *Somerset, Mass., *Dunbarton, N. H., and Salt Lake City, 13.50 in.; *Cooperstown and *Flushing, N. Y., 13.00 in.; LaCrosse, *Manitowoc, Wis., and Bismarck, 12.50 in.

Those stations marked with a star, (*) have been reported by Voluntary Observers, or U. S. Army Post Surgeons.

The *depth of snow on ground at end of month* was reported as follows:—in Maine, from 4 to 12 inches; New Hampshire, 15 in.; Vermont, 2 to 18 in.; Massachusetts, trace on the coast to 18 in. in the interior; Connecticut, 2 to 3 in.; Rhode Island, 2 in.; New York, $\frac{1}{2}$ to 12 in.; Pennsylvania, $\frac{1}{2}$ to 7 in.; New Jersey, trace to 2 $\frac{1}{2}$ in. in the interior; Ohio, $\frac{1}{2}$ along lake coast to 5 in. in the interior; Michigan, northern peninsula, 5 $\frac{1}{2}$ to 10 in.; southern peninsula, 2 in. at Port Huron to 24 in. at Northport; Wisconsin, 2 to 6 in.; Illinois, 0.7 to 5 in.; Missouri, trace to 2 in. in northern half; Iowa, trace to 9 $\frac{1}{2}$ in.; Minnesota, 7 to 25 in.;

Dakota, 1 to 23 in.; Nebraska, $\frac{1}{2}$ to $8\frac{1}{2}$ in.; Kansas, $1\frac{1}{2}$ to 3 in.; Colorado, 24 in. on summit of Pikes Peak; Montana, 1 in. at Virginia City; Utah, 3 to 8 in.; Nevada, trace to 7 in.; California, 1 in. at San Geronio, near Visalia at an elevation of 3,000 ft., 20 in., and at 11,000 ft., 108 in.

Snow from a cloudless sky.—Milwaukee, Wis., 10th; Burlington, Vt., 19th.

Floods.—Los Angeles, Cal., 20th, mountain streams badly swollen from heavy rains, washing away roads and bridges and interrupting rail-road communication for 36 hours. Phoenix, Ariz., 29th, unusually heavy rain-storm, river rose ten feet in two days, causing slight damage. Cape May, N. J., 14th, city flooded by high tides, submerging rail-road tracks, extinguishing locomotives' fires, stopping trains and causing passengers to be brought to the city in boats; two hundred yards of sea-wall washed away. Morgantown, West Va., 25th, the inner wall of canal-lock, near Hoard's Rock, partly carried away by the freshet.

Droughts.—San Antonio, Tex., 1st, everything suffering for want of rain; the present drought is unprecedented, its severity causing a check upon immigration. Melissa, Tex., 18th to 23rd, streams mostly dried up and also wells, cisterns and springs.

RELATIVE HUMIDITY.

The percentages of mean relative humidity for the month range as follows: New England, 73 to 83; Middle Atlantic States, 70 to 84; South Atlantic States, 70 to 87; Eastern Gulf States, 76 to 86; Western Gulf States, 62 to 81; Ohio valley and Tennessee, 66 to 78; Lower Lake region, 72 to 82; Upper Lake region, 69 to 81; Upper Mississippi valley, 66 to 74; Missouri valley, 67 to 94; Red River of the North valley, 98 to 99; Eastern Rocky Mountain Slope, 52 to 69; Texas, 20 at Stockton to 83 at Rio Grande; Western Plateau, 43 to 75; California, 68 to 84; Oregon, 78 to 86. *High stations* report the following averages not corrected for altitude: Pike's Peak, 70.1; Denver, 58.8; Cheyenne, 47.9; Virginia City, 62.8; Santa Fe, 49.9; Mt. Washington, 86.4 per cent.

WINDS.

The prevailing winds, at the Signal Service stations, are indicated on chart No. II by the arrows, which fly with the wind. The *maximum* hourly velocities, as recorded by self-registers, have been noted in descriptions of the movements of areas of low and high pressure.

Total Movements of the Air.—The following are the *largest* total movements recorded in miles at the Signal Service stations during the month: on the summit of Pike's Peak, 20,984 miles; Sandy Hook, 12,066; Thatcher's Island, 11,455; Cape May, 11,387; Indianola, 10,739; Milwaukee, 10,700; Cape Look-out, 10,414; Kitty Hawk, 10,324; Sandusky, 10,012; Barnegat, 10,005; Wood's Holl, 9,930; Cape Henry, 9,710; Cheyenne, 9,502; Fort Sill, 9,144; Eastport, 8,868; Cape Hatteras, 8,843; Breckenridge, 8,728; Dodge City, 8,646. The *smallest* are: Deadwood, 1,740 miles; Visalia, 1,769; La Mesilla, 2,138; Augusta, 2,194; Lynchburg, 2,362; Uvalde, Tex., 2,794; Nashville, 2,817; Baltimore, 3,005; Silver City, N. M., 3,080; Virginia City, 3,078; La Crosse, 3,156; Los Angeles, 3,387; Savannah, 3,500; Eagle Pass, Tex., and Salt Lake City, 3,604; Fort Buford, Dak., 3,606; Laredo, 3,644; Boise City, 3,707; San Antonio, Tex., 3,727; Springfield, Mass., 3,811; Charlotte, N. C., 3,946.

Local Storms.—Winnemucca, Nev., 16th, p. m., a severe whirlwind passed from southwest to northeast, causing considerable damage, track one mile wide and lasting fifteen minutes. Colorado Springs, Col., 28th, violent gale from the west, destroying fences, signs and buildings; at a point 12 miles north of station a parlor car and one engine were lifted from the track and thrown down an embankment. Renick, Randolph Co., Mo., 9th, a severe tornado passed near the town at about 4 p. m., causing great havoc. The storm first appeared in the shape of a dense rolling cloud, hiding the sun and making it appear for miles as dark as night. The first warning of the tornado was signaled by a little black speck to the south-east of the town, which gradually grew larger until it seemed to cover the whole heavens, when the wind increased to hurricane violence. Many buildings were literally torn to pieces; fences and grain-stacks scattered in every direction, and portions of the railroad track torn up and carried great distances. Several animals were killed outright and many persons badly injured. The track of the storm was very narrow and the storm lasted but a few moments. Parker's station, Scott Co., Mo., 10th, a severe wind-storm passed over this point between twelve and one o'clock p. m., destroying several large sheds, each 100 feet in stored length, with staves, scattering the material in every direction. Two buildings were unroofed, large trees were uprooted and many fences and outbuildings entirely destroyed. Burlington, Vt., 24th, very severe wind-storm, snow piled in heavy drifts, several sheds and other buildings blown down and much damage to other property.

Sand-storms.—Coleman, Tex., 4th and 9th; Fort Garland, Col., 8th; Yuma, Ariz., 24th and 25th—very violent.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for December, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 85.7 per cent. The percentages for the four elements are: Weather, 88.1; Direction of the Wind, 81.5; Temperature, 87.7; Barometer, 85.4 per cent. By geographical district they are for New England, 89.4; Middle States, 84.7; South Atlantic States, 85.1; Eastern Gulf States, 85.9; Western Gulf States, 85.6; Lower Lake region, 87.8; Upper Lake region, 84.4; Tennessee and the Ohio valley, 83.9; Upper Mississippi

valley, 86.2; Lower Missouri valley, 83.9; Northern Pacific coast region, 87.5; Central Pacific coast region, 86.6; Southern Pacific coast region, 88.3 per cent. There were 16 omissions to predict out of 3,813, or 0.42 per cent. Of the 3,797 predictions that have been made, 69, or 1.82 per cent, are considered to have entirely failed; 128, or 3.37 per cent, were one-fourth verified; 539, or 14.19 per cent, were one-half verified; 429, or 11.30 per cent, were three-fourths verified; 2,732, or 69.32 per cent, were fully verified, so far as can be ascertained from the tri-daily weather maps.

Cautionary Signals.—270 Cautionary Signals were displayed during the month, of which 223, or 82.5 per cent., were justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of the station. 82 Off-shore Signals were displayed, of which 63, or 76.8 per cent, were fully justified; 72, or 87.8 per cent, were justified as to direction; 67, or 81.1 per cent, were justified as to velocity; and 6, or 7.3 per cent, were not justified either as to direction or velocity. 43 of the Off-shore were changed from Cautionary. 309 Signals of both kinds were displayed, of which 251, or 81.2 per cent, were fully justified. The above does not include signals ordered for 50 display stations, where the velocity is only estimated. 46 cases of winds of 25 miles and over per hour, from scattering stations, were reported, and for which signals had not been ordered. One signal was reported late.

NAVIGATION.

In the table on the right-hand side of chart No. III are given the highest and lowest readings of the Signal Service river-gauges for the month, with the dates of the same. The *Savannah*, at Augusta, changed but little previous to the 13th, then rose quite rapidly during the 15th, and reached its maximum of 30 feet on the 16th. During the remainder of the month it fell quite steadily. The *Red* continued nearly stationary during the first half of the month at a little less than 3 feet below the bench mark, (previous low water mark,) at Shreveport, then slowly rose, reaching the bench-mark night of the 18th, and its maximum height at the close of the month. In the *Arkansas*, at Little Rock, the oscillations have been slight and gradual, excepting a rise of nearly 5 feet on the 25th and 26th. The *Tennessee*, at Chattanooga, changed but little previous to 11th. During that day and the following it rose over 10 feet; on the 15th and 16th nearly 6 feet; 23rd to the 26 nearly 15 feet. At Nashville, the *Cumberland* rose over 8 feet from the 5th to 7th; fell over 5 feet to the 9th; rose over 17 feet by the 12th, and 7 more by the 16th; fell over 21 feet up to the 22nd; rose 22 feet by the 29th, when it reached its maximum. In the *Ohio* the changes were unimportant, excepting a slow increase of depth of water, until the 24th and 25th, when the river rapidly rose at Pittsburgh and Cincinnati; the 26th to 28th, from Louisville down. For the *Missouri* the changes are of little interest. At Yankton the river was frozen after the 2nd; at Omaha, after the 10th; at Leavenworth, after the 12th. In the *Mississippi*, above Cairo, the changes were slight and gradual. The river was frozen at St. Paul after the 7th; at La Crosse, after the 11th; at Dubuque, after the 16th; at Davenport, after the 18th; at Keokuk, after the 24th. At Cairo the river slowly rose to 30 feet by the 17th; fell to 25 feet on 23rd; then rose to its maximum at close of month. At Memphis it rose to 25 feet by the 20th; fell to less than 21 feet by 25th; then rose to nearly 27 feet on the 31st. At Vicksburg it steadily rose to over 30 feet by 25th, and remained nearly stationary thence to end of month. At New Orleans there was quite a steady and slow rise.

Ice in Rivers and Harbors.—The following notes on the formation of ice are of interest: The *Columbia river*.—At Umatilla, Or., closed to navigation on the 19th. The *Missouri*.—At Plattsburgh, Neb., ice gorged at rail-road pile bridge and froze solid on the 10th; 18 to 20 inches thick on the 31st. At Leavenworth, Kan., on the 11th and 12th, floating ice; 13th, ice gorged; 14th, river frozen over. At Kansas City, Mo., floating ice from 11th to 14th, river closed on 15th. Creswell, Kan., 12th, creeks frozen over. *Platte river*.—Closed with ice, and teams crossing on the 13th. The *Mississippi*.—At St. Paul, Minn., frozen over on the 8th. At LaCrosse, Wis., closed by ice on the 12th. At Dubuque, Ia., free of ice on the 5th; gorged on the 13th; frozen over on the 17th, passengers and teams crossing. At Davenport, Ia., floating ice on 1st, 11th, 12th, 15th to 18th; last boat of season passed down on the 14th; navigation closed on the 17th; frozen over on the 19th; vehicles crossing on ice 22nd. At Burlington, Ia., floating ice on the 1st, 2nd, 10th, 12th to 15th; navigation closed on the 10th; nearly frozen over on the 16th; frozen over on the 18th; people crossing on the ice on the 19th; teams crossing on the 20th. At Muscatine, Ia., frozen over on the 18th; teams crossing on 22nd. At Keokuk, Ia., floating ice from the 11th to the 25th, inclusive; river closed on the 25th; ice broken up on the 28th; navigation closed on the 11th. At St. Louis, Mo., floating ice on the 16th and 17th; 18th, navigation suspended; 21st, heavy; 22nd, 24th, 25th; 26th, gorged near bridge; 27th, 28th; gorged at St. Charles, 29th; river nearly clear on 30th. At Cairo, Ill., floating ice from 18th to 31st; very heavy from 26th to 31st, causing entire obstruction of navigation. *Des Moines river*.—At Des Moines, Ia., closed by ice on the 13th. At Boonesboro, Ia., closed by ice strong enough for teams to cross on the 10th. *Rock river*.—At Rockford, Ill., frozen over solid on the 12th; Lyndon, Ill., 12th, river closed with ice above the dam; 25th, closed with ice the below dam. *Skunk river*.—Ames Ia., river frozen over during the month. Tabor, Ia., 31st, ice in creeks fourteen inches thick. *Cottonwood river*.—Creswell, Kan., 26th, river and neighboring creeks frozen over. Wellington Kan., 31st, ice in creeks six inches thick. Cedar Vale, Kan., 12th to 31st, Cana creek frozen over. The *Ohio*.—At Cairo, Ill., drift wood in river from the 7th to the 17th, and from the 28th to the 31st. At Cincinnati, full of floating ice on the 27th. Miami canal closed by ice on the 26th. *Hudson river*.—At Garrison's, N. Y., navigation entirely suspended on the 31st. *Susquehanna*.—At Catawissa, Pa.,

closed by ice in several places on the 31st; navigation closed on north branch of Pennsylvania canal on the 17th; on the west branch on the 12th; canal frozen over on the 18th. *Connecticut*.—Springfield, Mass., 22nd, river closed with ice; 29th, river in many places clear of ice; Fall River, Mass., 22nd, North Watuppa Lake, frozen for first time this season. *St. Lawrence river*.—frozen over at Montreal on the 29th. *Newburyport, Mass.*—river and harbor entirely free from ice on 31st. *Lakes*.—Marquette, Mich., harbor frozen over from 18th to 21st. Grand Haven, Mich., harbor frozen over from 16th to 31st. Duluth, Minn., harbor frozen from 12th to 31st. Escanaba, Mich., ice in bay entire month. Port Huron, Mich., navigation closed on the 14th; Ft. Gratiot light extinguished for the season on the 19th. Alpena, Mich., last steamer of season left for Detroit on the 7th; bay full of ice on 12th. Chicago, Ill., lake frozen along the shore on the 15th; navigation closed on the 16th; all vessels laid up on the 17th. Buffalo, N. Y., canal navigation closed on the 6th, lake navigation on the 27th; Buffalo Creek and river frozen over on 26th. Oswego, N. Y., navigation closed on the 1st; all vessels laid up for the winter on the 11th. Detroit, Mich., floating ice in river on the 16th; ice along shore on the 26th. Cleveland, Ohio, navigation closed on the 9th; ice forming along the wharves on the 16th; river frozen over, 18th; floating ice in lake in large quantities on the 26th. Toledo, Ohio, navigation practically closed on the 4th; river partly covered by ice, 13th; frozen over, 16th; navigation closed, 17th. Erie, Pa., harbor lights discontinued for the season. *Lake Champlain*.—Burlington, Vt., ice broken up in river on the 15th; on the 15th at Rouse's Point, Can., 45 vessels fast in the ice, and between Rouse's Point and Sorel 100 vessels ice-bound; lake frozen over from Crown Point to Whitehall; people and teams crossing on ice between Ticonderoga and Bridgeport on the 26th; ice bridge between St. Alban's, Vt., and the islands in the lake firm on the 29th, and 6 inches thick in the thinnest part.

High Tides.—Cape Lookout, N. C., 13th; Macon, N. C., 13th, 14th, 15th, 16th; Atlantic City, N. J., 15th, very high tides, trains delayed in crossing the meadows.

Low Tides.—Indianola, 26th, 27th, 28th, 29th, 30th, 31st.

TEMPERATURE OF WATER.

The *temperatures of water*, as observed in rivers and harbors, with average depth at which observations were taken, are given in table on left side of chart No. II. At the following stations observations were not made on the dates indicated: on account of ice, at Alpena, from 21st to 31st, inclusive; Buffalo, 26th to 31st; Chicago, 15th to 31st; Detroit, 16th to 23rd and 26th to 31st; Duluth, 13th to 31st; Escanaba, 1st to 31st; Grand Haven, 16th to 31st; Marquette, 18th to 21st; Milwaukee, on the 21st and 23rd; Toledo, 16th to 31st. At Cleveland the lake was too rough for observations to be taken on the 7th, 10th, 11th, 15th and 22nd. At Savannah, 15th to 21st; at Punta Rasa, 6th to 31st, and Augusta, 14th to 25th, observations were interrupted by loss or breakage of thermometer.

ATMOSPHERIC ELECTRICITY.

Thunder-storms were reported in the various states on the following dates:—Pennsylvania, 11th; New Jersey, 6th; Maryland, 6th, Virginia, 6th, 26th; North Carolina, 6th; Georgia, 11th, 15th; Florida, 5th, 11th, 15th; Alabama, 5th; Mississippi and Louisiana, 5th, 10th; Texas, 4th, 5th, 9th, 10th, 13th, 23rd, 24th, 31st; Arkansas, 3rd, 9th, 24th; Indian Territory, 4th; Tennessee, 6th, 22nd, 23rd; Ohio, 9th, 21st, 22nd; Indiana, 3rd, 9th, 21st, 22nd; Michigan, 9th, 10th; Wisconsin, 9th; Iowa, 9th; Illinois, 9th, 10th, 21st; Missouri, 4th, 5th, 9th, 21st; Kansas, 4th, 5th, 9th, 30th.

Auroras.—Cornish, Me., 7th, 8th. Fall River, Mass., 12th. Thornville, Mich., 10th, 9 p. m., dimly defined arch with streamers. Argyle, N. Y., 17th, 9 p. m., diffuse light. Cambridge, Mass., regularly looked for at 8 p. m.; suspected, 7th, 9th; decidedly cloudy, 2nd, 3rd, 5th, 6th, 8th, 10th, 11th, 13th, 14th, 16th, 19th, 20th, 24th; some clouds or haze, 4th, 15th; some clouds and moonlight, 1st, 17th, 21st; moonlight, 18th, 26th, 27th; no record, 22nd, 23rd, 25th, 28th, 29th, 30th, 31st; aurora, if present, would have been seen on the 12th. Burlington, Vt., 7th, 11 p. m., an arch of light, of a pale green, with a few streamers above a well defined dark segment; 8th, 9 p. m., diffuse light. Wellsboro, Pa., 12th, 8.20 to 10.30 p. m.; 18th, 9 p. m. to midnight. Newport and Woodstock, Vt., 8th. Manitowoc, Wis., 7th, 11th.

Telegraphic communication interfered with by atmospheric electricity.—Bismarck, 10th, 22nd, 23rd; Coleman and Mason, Tex., 4th; Indianola, 5th, 12th, 18th.

OPTICAL PHENOMENA.

Solar Halos were observed in the various districts on the following dates: New England, 18th to 21st, 23rd to 25th, 28th to 31st. Middle Atlantic States, 1st to 3rd, 16th, 18th, 20th to 25th, 27th to 31st. South Atlantic States, 3rd, 4th, 8th, 11th, 19th to 22nd, 24th, 27th, 29th, 30th, 31st. Eastern Gulf States, 1st, 18th, 19th, 21st, 23rd, 27th, 28th. Western Gulf States, 1st, 2nd, 3rd, 18th to 23rd, 27th. Lower Lake region, 1st, 3rd, 18th, 23rd, 25th, 27th. Upper Lake region, 1st, 2nd, 20th, 24th, 25th, 27th, 28th, 31st. Ohio valley and Tennessee, 1st, 2nd, 19th, 24th to 28th, 30th. Upper Mississippi valley, 1st, 2nd, 6th, 10th, 11th, 15th, 17th, 20th, 24th, 26th to 30th. Missouri valley, 1st, 2nd, 3rd, 4th, 17th, 18th, 19th, 20th to 24th, 27th to 31st. Rocky Mountains, 2nd, 18th, 23rd, 26th, 27th, 28th. Western Plateau, 1st, 21st, 23rd, 26th, 28th, 30th. California, 5th, 23rd. Washington Territory, 4th.

Lunar Halos were observed in the various districts on the following dates: New England, 1st, 2nd, 3rd, 13th, 19th, 23rd to 25th, 27th, 30th; Middle Atlantic States, 3rd, 13th, 26th, 27th; South Atlantic

States, 3rd, 19th, 21st, 25th; Eastern Gulf States, 3rd, 5th, 7th, 11th, 12th, 19th, 21st, 25th; Western Gulf States, 2nd, 7th, 8th, 11th; Lower Lake region, 4th, 13th, 16th, 19th, 23rd, 24th, 27th; Upper Lake region, 13th, 28th, 30th; Ohio valley and Tennessee, 1st, 7th, 8th, 13th, 28th; Upper Mississippi valley, 2nd, 7th, 10th, 11th, 12th, 13th, 14th, 15th, 24th, 25th, 27th, 31st; Missouri valley, 1st, 7th, 8th, 11th, 14th, 16th, 17th, 18th, 20th to 22nd, 24th to 31st; Western Plateau, 17th, 21st, 26th, 27th; California, 9th, 12th, 22nd, 27th; Washington Territory, 14th, 22nd.

MISCELLANEOUS PHENOMENA.

Sunsets.—The characteristics of the sky at sunset, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service Stations. Reports from 131 stations show 4,042 observations to have been made, of which 32 were reported doubtful; of the remainder, 3,264, or 81.4 per cent., were followed by the expected weather.

Meteors.—Belvidere, Ill., 31st; New Corydon, Ind., 13th, 17th, 18th, 26th, 27th; Spiceland, Ind., 1st; Wabash, Ind., 15th, 11:30 p. m., a very large and brilliant meteor passed from SE. to NW., lighting up the whole heavens; Woodstock, Md., 7th, 12th, 13th, 15th, 16th; Westborough, Mass., 12th, 13th; Rowe, Mass., 7th, 9th; Ashley, Mo., 12th; Clear Creek, Neb., 2nd; Austin, Neb., 12th; Freehold, N. J., 16th; Atco, N. J., 17th; Waterburg and North Volney, N. Y., 13th; North Platte, 13th; Castroville, Tex., 11th; Pensacola, Fla., 1st, 10th, 19th; Springfield, Ill., 10th; Madison, Wis., 16th; Chambersburg, Pa., 12th; Ashwood, Tenn., 16th; Maiden Rock, Wis., 30th; Mr. H. H. Ten Broeck, reported the appearance of a remarkably brilliant meteor at 6:45 p. m. It was first observed about 37° above the western horizon moving in a southwesterly direction. It left a trail about 5° long equally divided into yellow, scarlet and violet bands, lasting about ten seconds when suddenly changing into a yellow cloud it disappeared.

Earthquakes.—United States Naval Hospital, Yokohama, Japan, October 17th, 1879, 1:31 and 2:17 p. m., light shocks; 18th, 1:52 a. m., severe shock, duration 45 seconds; 25th, 0.40 a. m., light shock; 30th, 9.44 a. m., light shock; November 15th, 9.30 a. m., two smart shocks, duration 7 seconds. Two distinct shocks moving from west to east were felt at Charlotte, N. C., and in the surrounding country within a radius of 11 miles, the one at 7 p. m. of the 12th, and the other at 2 a. m. of the 13th. The second was sufficiently distinct to rouse from sleep persons living in Charlotte, Sharon township, Providence, and Pineville. At Los Angeles, Cal., slight shock at 8:15 p. m. of the 7th, lasting about two seconds.

Zodiacal Light.—Monticello, Ia., 8th, 11th, 13th. Cedar Vale, Kan., 11th, 12th, 13th. Yates Center, Kan., 5th, 6th, 10th, 11th, 12th, 13th. Rowe, Mass., 5th, 9th. Oregon, Mo., 13th. Clear Creek, Neb., 12th. Atco, N. J., 1st, 2nd, 12th, 13th. Cambridge, Mass., regularly looked for at 8 p. m.; suspected through haze on the 4th; somewhat visible 7th, 9th, 12th; observations on other evenings hindered by moonlight or clouds. Lynchburg, 30th, 31st. Southington, Conn., 15th. Wytheville, Va., 1st, 3rd, 4th, 6th, 7th, 8th, 12th, 16th.

Prairie and Forest Fires.—Creswell, Kan., 1st, 2nd, 3rd, 8th, 13th to 16th, 20th, 24th, 25th; Dodge City, 10th, 11th, 12th; Fort Sill, 3rd, 7th, 9th, 10th, 15th, 17th; Fort Gibson, 1st, 2nd, 13th, 17th, 26th; Henrietta, Tex., 3rd, 9th, 10th; New Orleans, 29th.

Polar Bands.—New Corydon, Ind., 5th, 13th, 18th, 27th; Tabor, Ia., 27th; Yates Center, Kan., 2nd, 29th, 31st; Gardiner, Me., 8th, 13th, 19th, 28th; Clear Creek, Neb., 2nd, 20th, 27th; Freehold, N. J., 3rd, 28th; Vineland, N. J., 29th; Pembina, 3rd; Milwaukee, 22nd; Wytheville, Va., 7th, 12th, 27th.

Mirage.—Genoa, Neb., 10th, 12th, 13th, 22nd; Pembina, 5th, 11th, 18th, 22nd, 24th, 31st; Cape Lookout, N. C., 3rd; Macon, N. C., 3rd.

Sun Spots.—The following record of observations made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent Nautical Almanac Office, Washington, D. C.:—

DATE— Dec., 1879.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		REMARKS.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
1st, 8 a. m.	0	0	0	0	0	0	1	3	} Faculae.
rd, 9 a. m.	0	0	0	0	0	0	1	3	
7th, 8 a. m.	0	0	—	—	0	0	0	0	
7th, 10 a. m.	0	0	0	0	0	0	0	0	
8th, 4 p. m.	0	0	0	0	0	0	0	0	
9th, 9 a. m.	1	3	—	—	0	0	1	3	} Spots faint. Faculae.
12th, 9 a. m.	0	0	—	—	0	0	0	0	
13th, 8 a. m.	0	0	0	0	0	0	0	0	
15th, 4 p. m.	0	0	0	0	0	0	0	0	
16th, 8 a. m.	1	2	0	0	0	0	1	2	} These 2 spots have had a large relative motion since } morning observation.
16th, 4 p. m.	0	0	0	0	0	0	1	2	
17th, 3 p. m.	0	0	0	0	0	0	1	2	
18th, 9 a. m.	0	2	0	0	0	0	1	4	
26th, 9 a. m.	0	0	—	—	0	0	0	0	
27th, 9 a. m.	0	0	0	0	0	0	0	0	
28th, 3 p. m.	0	0	0	0	0	0	0	0	
30th, 8 a. m.	0	0	0	0	0	0	0	0	
30th, 2 p. m.	0	0	0	0	0	0	0	0	

Mr. Wm. Dawson, at Spiceland, Ind., reports "on the 5th, 2 small spots 6' from west edge; considerable faculae in SE. quadrant; air poor. 9th, 3 small spots near centre, much cloud. 16th, 3 small spots 5'

from east edge, air bad. 22nd, one moderate-sized spot 6' from west edge, air bad. 26th, no spots, too cloudy to observe well. 31st, 4 spots in one group about 7' north of centre." Mr. H. D. Govey, at North Lewisburg, Ohio, reports "observed two large sun spots on the 18th, at 9:15 a. m. Lewisburg mean time."

Mr. F. Hess, at Fort Dodge, Iowa, reports: "during the first week of the month, when a group of three or more spots should have been visible, the sun could not be observed on account of cloudiness. 17th and 18th, 10 a. m., one large double spot with penumbra and one small one in SE. quadrant. 19th, 11 a. m., one large and one small spot within a common penumbra and two small ones in SE. quadrant. 20th, 11 a. m., only one spot indistinctly visible, on account of haze, in SW. quadrant. 22nd, 9 a. m., one large spot in SW. quadrant. The sun was examined on all other clear days of the month but no spots noticed."

Mr. David Trowbridge, at Waterburg, N. Y., reports "sun observed on 7th, 9th, 12th, 13th 16th, 26th, 27th and 28th, no spots. On the 18th, 3 p. m., a small spot about $\frac{1}{2}$ diameter of the disc from the west margin; 18th, one group of two well defined spots about $\frac{1}{2}$ diameter from east margin of disc; 19th, the two spots still visible; 21st, only one spot visible."

Prof. Hinrichs, at Iowa City, Iowa, "Sun spots were seen on the 1st."

At Fort Whipple, Va., observations were continued throughout the month, but no spots reported.

Precipitation received after issue of November Review.—*Washington Ty.*: Neah Bay, 8.78 inches; Fort Canby, 5.60; Bainbridge Island, 4.40; Walla Walla, 1.83; Fort Townsend, 1.50; Fort Colville, 1.03 in. *Oregon*: Fort Stevens, 8.68; Albany, 5.80; Fort Klamath, 5.78; Eola, 4.00; Fort Harney, 3.34; Umatilla, 0.61 in. *Idaho Ty.*: Fort Lapwai, 2.36 in. *Montana*: Fort Ellis, 0.30; Blackfeet Agency, 0.21; Forts Benton and Shaw, 0.06; Fort Logan, trace. *Dakota*: Fort Totten, 0.20; Fort Meade, 0.04; Fort Sully, 0.03; Forts Hale and Sisseton, trace. *Michigan*: Fort Brady, 2.12 in. *Iowa*: Clarinda, 3.68 in. *Wyoming*: Fort Fetterman, 0.26 in. *Colorado*: State Agricultural College, Fort Collins, 1.50 in. *Nevada*: Pioche, 0.08 in. *California*: Fort Gaston, 11.24; Oakwood Rancho, 3.61; Oakland, 2.98; Poway, 2.75; Campo, 3.00; Fort Bidwell, 1.75 in. *Arizona*: Fort Apache, 2.12; Burkes, 1.22; Florence, 0.79; Wickenburg, 0.00 in. *New Mexico*: Fort Wingate, 0.51 in. *Kansas*: Independence, 2.15 in. *Texas*: Fort Bliss, 0.01; Fort Ringgold, 0.00 in. *Florida*: Biscayne, 1.00; Okahumpka, 0.00 in.

Mean Temperature for Umatilla, Or., for November is 37°.6, or 4°.2 below the average for several years; *maximum* 61° and *minimum* 15°; prevailing wind-direction, SE.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

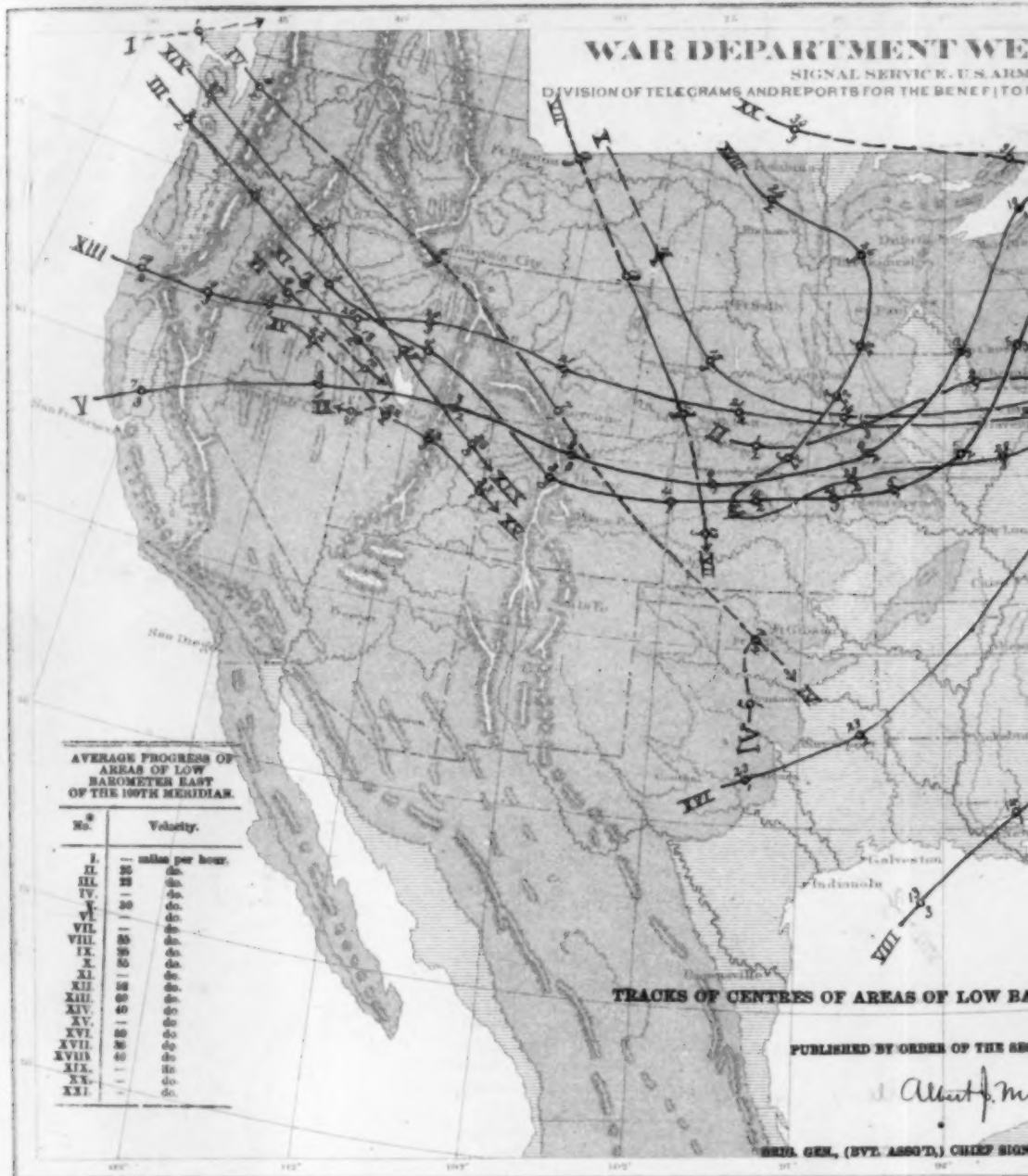
Brig. Gen. (Bvt. Assg^d.) Chief Signal Officer, U. S. A.

Copy furnished for

WAR DEPARTMENT WE

SIGNAL SERVICE, U.S. ARMY

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT TO



AVERAGE PROGRESS OF
AREAS OF LOW
BAROMETER EAST
OF THE 100TH MERIDIAN.

No.	Velocity.
I.	— miles per hour.
II.	25 do.
III.	25 do.
IV.	— do.
V.	30 do.
VI.	— do.
VII.	— do.
VIII.	30 do.
IX.	30 do.
X.	30 do.
XI.	— do.
XII.	30 do.
XIII.	30 do.
XIV.	40 do.
XV.	— do.
XVI.	30 do.
XVII.	30 do.
XVIII.	40 do.
XIX.	— do.
XX.	— do.
XXI.	— do.

TRACKS OF CENTRES OF AREAS OF LOW BAROMETER

PUBLISHED BY ORDER OF THE SECRETARY OF WAR

Albert J. M.

CHIEF SIGNAL OFFICER, U.S. ARMY

No. 1.

WEATHER MAP.

U. S. ARMY.
BENEFIT OF COMMERCE AND AGRICULTURE



LOW BAROMETER FOR DECEMBER, 1879.

OF THE SECRETARY OF WAR.

CHIEF SIGNAL OFFICER, U. S. A.

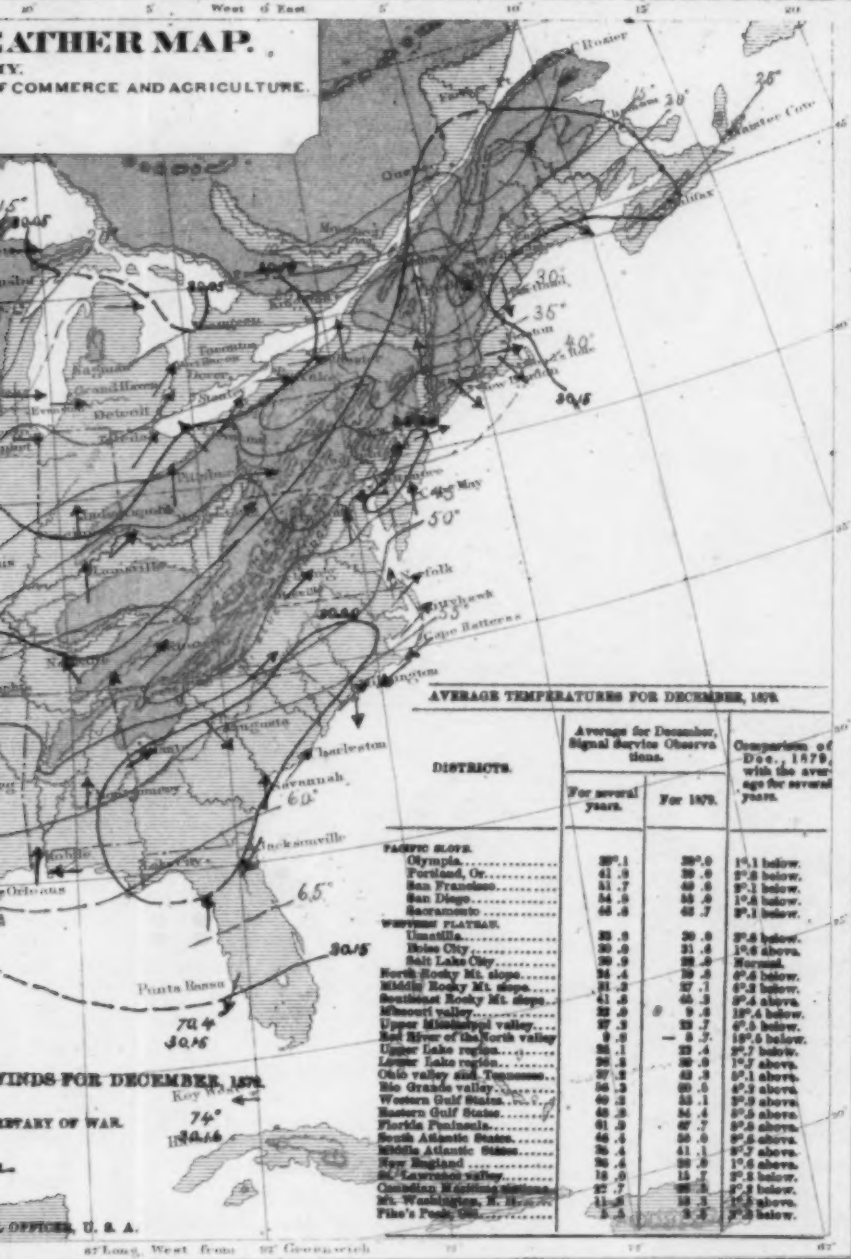
NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7 A. M., the 4 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer at the day and hour, written respectively above and below the line.

DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE



WEATHER MAP.

OF COMMERCE AND AGRICULTURE.



AVERAGE TEMPERATURES FOR DECEMBER, 1879.

DISTRICTS.	Averages for December, Signal Service Observations.		Comparison of Dec., 1879, with the average for several years.
	For several years.	For 1879.	
PACIFIC SLOPE.			
Olympia.....	39.1	39.0	1.1 below.
Portland, Or.....	41.0	39.0	2.0 below.
San Francisco.....	41.7	40.0	1.7 below.
San Diego.....	54.0	55.0	1.0 below.
Sacramento.....	46.0	45.7	0.3 below.
WYOMING PLATEAU.			
Unionville.....	30.0	30.0	0.0 below.
Boise City.....	30.0	31.4	1.4 above.
Salt Lake City.....	30.0	30.0	Normal.
North Rocky Mt. slope.....	34.4	30.0	4.4 below.
Middle Rocky Mt. slope.....	31.0	27.1	3.9 below.
Southeast Rocky Mt. slope.....	41.0	40.0	1.0 below.
Blackfoot valley.....	30.0	0.0	30.0 below.
Upper Mississippi valley.....	37.0	37.7	0.7 below.
Red River of the North valley.....	0.0	0.0	0.0 below.
Upper Lake region.....	30.1	30.4	0.3 below.
Lower Lake region.....	30.1	30.0	0.1 above.
Ohio valley and Tennessee.....	37.1	40.0	2.9 above.
Big Grande valley.....	36.0	36.0	0.0 below.
Western Gulf States.....	40.0	36.1	3.9 below.
Eastern Gulf States.....	40.0	36.4	3.6 below.
Florida Peninsula.....	41.0	37.7	3.3 below.
South Atlantic States.....	44.0	40.0	4.0 below.
Middle Atlantic States.....	36.4	41.1	4.7 above.
New England.....	36.4	39.0	2.6 above.
St. Lawrence valley.....	18.0	11.7	6.3 below.
Canadian Maritime provinces.....	22.7	18.0	4.7 below.
Mt. Washington, N. H.....	11.0	10.0	1.0 below.
Fish's Peak, N. H.....	1.0	0.0	1.0 below.

WINDS FOR DECEMBER, 1879.

DEPARTMENT OF WAR.

OFFICE, U. S. A.

WAR DEPARTMENT WE
SIGNAL SERVICE U.S.A.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF
PRECIPITATION CHART FOR



AVERAGE PRECIPITATION FOR DECEMBER.

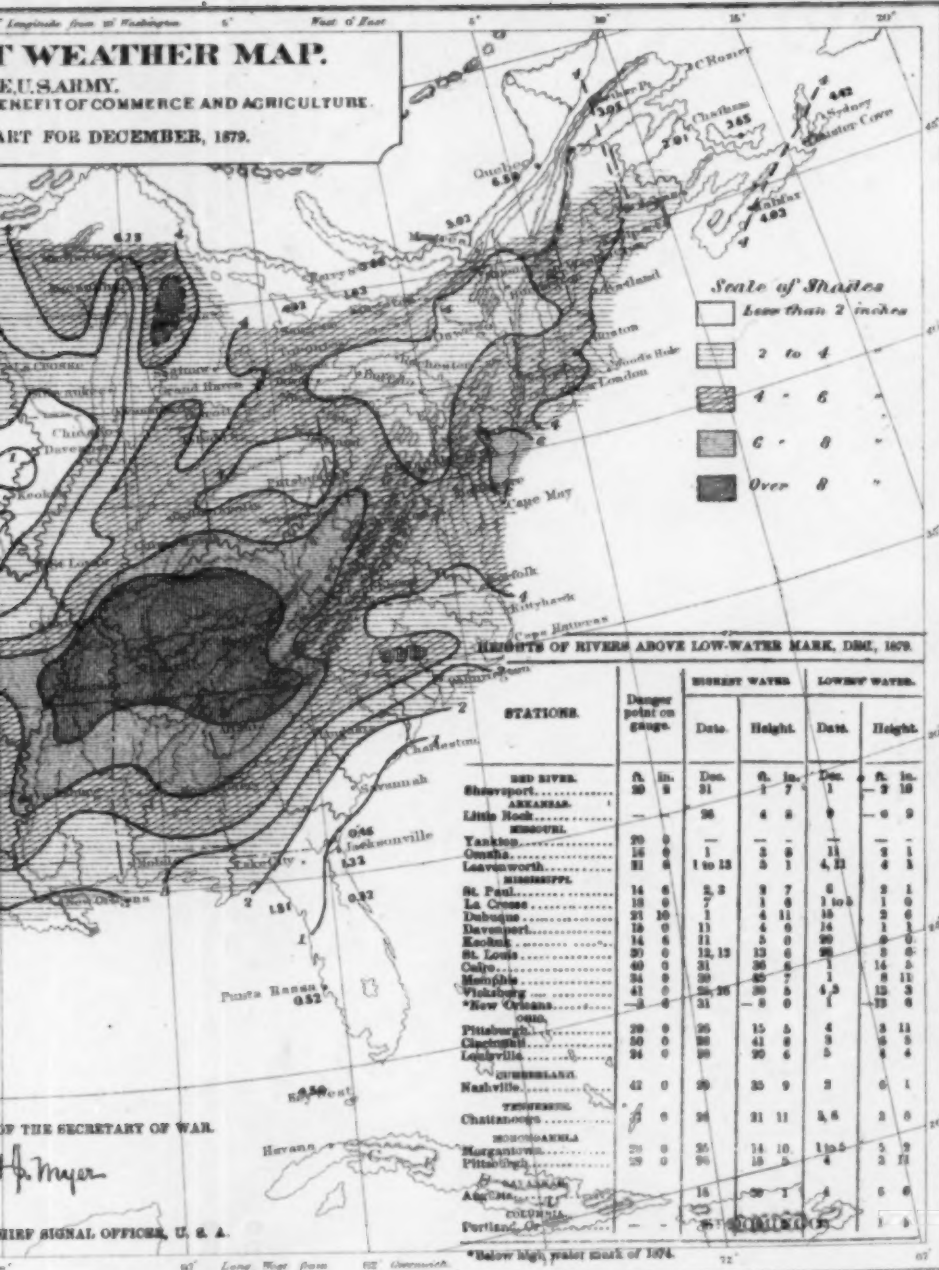
DISTRICTS	Average for December.		Comparison of December, 1879, with the average for many years.
	For many years.	For 1879.	
	Inches.	Inches.	Inches.
St. Lawrence Valley.....	3.15	3.06	2.44 excess.
New England.....	2.35	4.80	0.70 excess.
Middle Atlantic States.....	2.45	3.00	1.57 excess.
South Atlantic States.....	1.56	1.92	1.02 deficiency.
Florida Peninsula.....	2.34	1.75	0.59 deficiency.
Eastern Gulf States.....	4.43	4.74	0.31 excess.
Western Gulf States.....	4.90	2.76	2.14 deficiency.
Tennessee.....	3.31	3.00	0.31 excess.
Ohio Valley.....	3.00	0.41	2.59 excess.
Lower Lake Region.....	2.79	4.94	1.64 excess.
Upper Lake Region.....	1.86	3.03	1.67 excess.
Upper Mississippi Valley.....	2.10	1.56	0.54 deficiency.
Minnesota.....	0.75	2.31	1.56 excess.
Lower Missouri Valley.....	1.70	3.31	0.61 excess.
Upper Missouri Valley.....	0.69	1.04	0.55 excess.
California Coast.....	2.46	0.39	1.90 excess.
Portland, Or.....	3.17	7.30	0.81 deficiency.

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Albert J. Meyer

MAJ. GEN. (REV. ARMY) CHIEF SIGNAL

WEATHER MAP.
U.S. ARMY.
IN BENEFIT OF COMMERCE AND AGRICULTURE.
PART FOR DECEMBER, 1879.



OF THE SECRETARY OF WAR.
H. Meyer
SIGNAL OFFICERS, U. S. A.

WINDS ACCOMPANYING THE ATLANTIC STORMS.

American Coast.				European Coast.		
No.	Date.	Direction.	Miles per hour.	Day.	Direction.	Miles per hour.
11	Nov. 2nd	W. by N. by W.	25 to 40	Nov. 9th.	W. by N.	20 to 25 17 to 20 20.5

* Estimated from a scale of 0 to 9

No.	From	To	At or near
I.	from Nov. 14 to Nov. 14th, 1879		
II.	from Nov. 21st to Nov. 21st, 1879		
III.	from Nov. 28th to Nov. 28th, 1879		
IV.	from Nov. 5th to Nov. 5th, 1879		
V.	from Nov. 12th to Nov. 12th, 1879		
VI.	from Nov. 19th to Nov. 19th, 1879		
VII.	from Nov. 26th to Nov. 26th, 1879		
VIII.	from Nov. 3rd to Nov. 3rd, 1879		
IX.	from Nov. 10th to Nov. 10th, 1879		
X.	from Nov. 17th to Nov. 17th, 1879		
XI.	from Nov. 24th to Nov. 24th, 1879		
XII.	from Nov. 1st to Nov. 1st, 1879		
XIII.	from Nov. 8th to Nov. 8th, 1879		
XIV.	from Nov. 15th to Nov. 15th, 1879		
XV.	from Nov. 22nd to Nov. 22nd, 1879		
XVI.	from Nov. 29th to Nov. 29th, 1879		





INTERNATIONAL METEOROLOGY—OCEAN STORM TRACKS.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Alfred Meyer

BRIG. GEN. (RVT. ARMO'D) CHIEF SIGNAL OFFICER, U. S. A.

Broken or dotted lines indicate that the lines so broken are doubtful.

Arrows, when charted, fly with the wind and exhibit wind-direction.

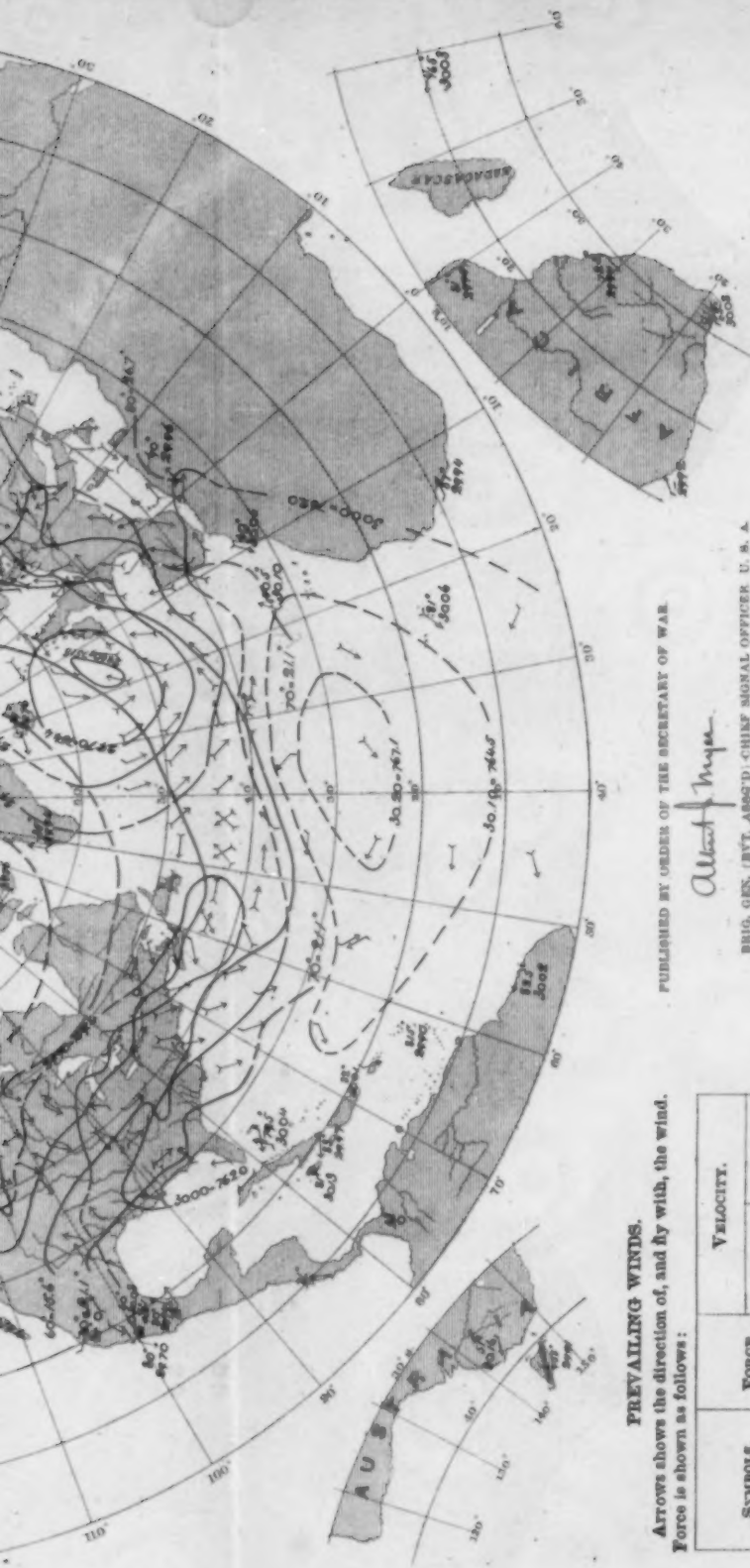
The tracks charted in black have appeared in previous Reviews.

The tracks charted in red have been made from data collected since preceding Reviews.

**Office of the Chief Signal Officer,
UNITED STATES ARMY.**

Charted from Actual Observations taken Simultaneously, Series commencing October, 1877.





PREVAILING WINDS.

Arrows show the direction of, and by with, the wind.
Force is shown as follows:

SYMBOL.	FORCE.	VELOCITY.	
		Miles per hour.	Metres per second.
↑	1, 2	0 to 9	0 to 4.0
↑↑	3, 4	10 to 22.5	4.3 to 10.1
↑↑↑	5, 6	22.5 to 40.5	10.1 to 18.1
↑↑↑↑	7, 8	40.5 to 67.5	18.1 to 30.3
↑↑↑↑↑	9, 10	67.5 up	30.3 & over.

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Albert Meyer

BRIG. GEN. (RET. ASSG'D) CHIEF SIGNAL OFFICER U. S. A.

ISOBARS AND ISOTHERMS.

Isobars in blue; detached barometer means in English inches.

Isotherms in red; detached temperature means in degrees Fahrenheit.

INTERNATIONAL MONTHLY CHART.

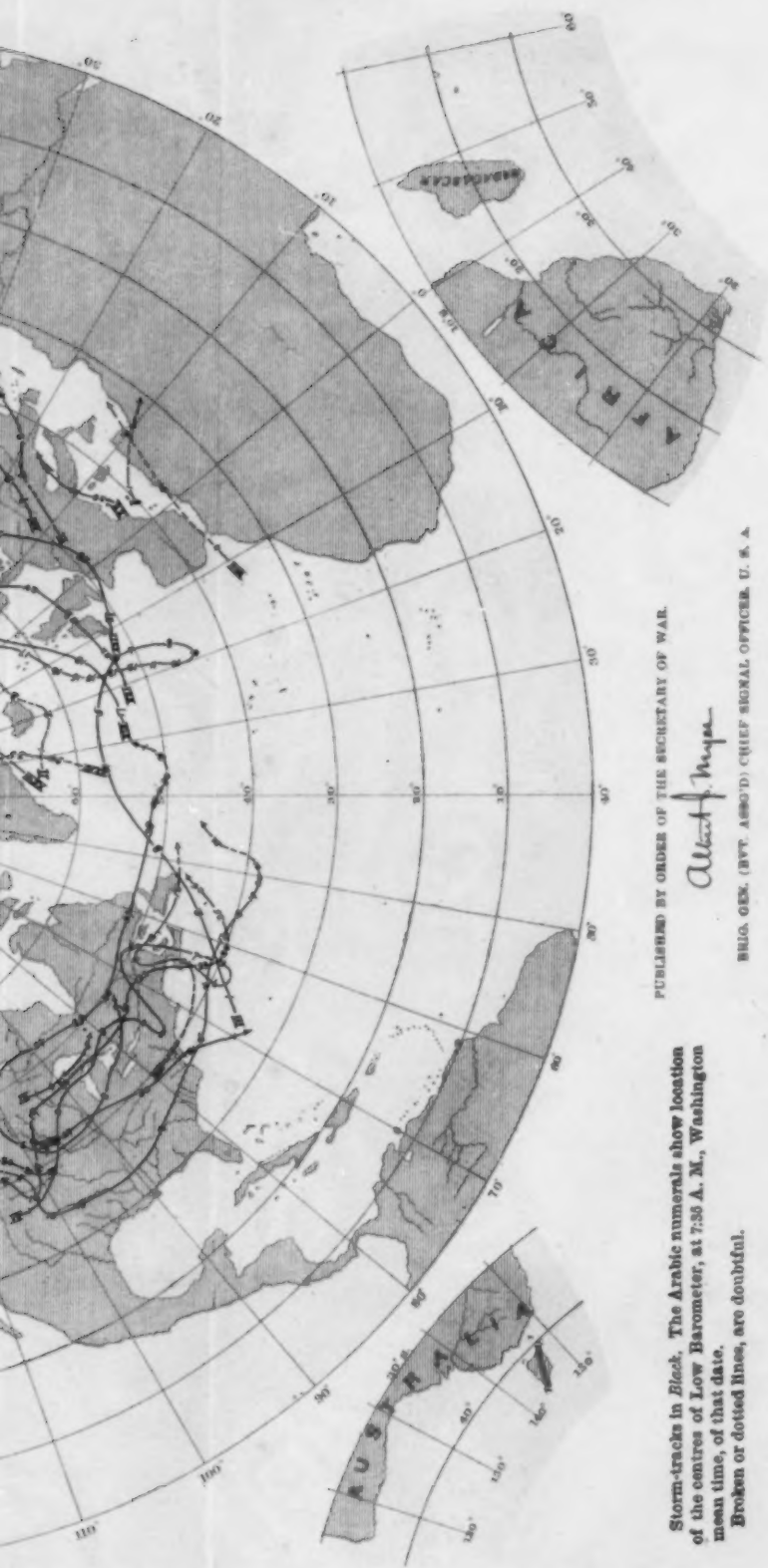
Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of May, 1878, based on the daily charts of the International Bulletin.

**Office of the Chief Signal Officer,
UNITED STATES ARMY.**

Charted from Actual Observations taken Simultaneously, Series commencing October, 1877.

No. VI.





PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert H. Meyer

HELIX GEE. (BVT. ASSD'D) CHIEF SIGNAL OFFICER, U. S. A.

Storm-tracks in Black. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

Broken or dotted lines, are doubtful.

INTERNATIONAL CHART.
Showing Tracks of Centres of Low Barometer for
May, 1918.